INFUSION OF NOREPINEPHRINE VERSUS PHENYLEPHRINE FOR PREVENTION OF SUBARACHNOID BLOCK INDUCED HYPOTENSION IN ELDERLY PATIENTS UNDERGOING HIP AND FEMUR SURGERIES

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DECLARATION BY THE CANDIDATE

I hereby declare that the thesis entitled **"INFUSION OF NOREPINEPHRINE VERSUS PHENYLEPHRINE FOR PREVENTION OF SUBARACHNOID BLOCK INDUCED HYPOTENSION IN ELDERLY PATIENTS UNDERGOING HIP AND FEMUR SURGERIES"** submitted towards partial fulfillment of the requirements for the award of **MD IN ANAESTHESIOLOGY** degree to BFUHS is a compilation of original work carried out by me under the supervision of **Dr. Neeru Luthra,** Professor, Department of Anaesthesiology, **Dr. M. Rupinder Singh,** Professor, Department of Anaesthesiology, **Dr. Pankaj Mahindra,** Professor, Department of Orthopaedics, in DMCH. No part of this thesis has formed the basis for the award of any degree previously.

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Dedicated

to

my Family

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"At times, our own light goes out and is rekindled by a spark from another person. Each of us has cause to think with deep gratitude of those who have lighted the flame within us."

-Albert Schweitzer

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This is a valuable experience I cherish everyday.

SHUBHAM LONGIA

LIST OF ABBREVIATIONS

NE	Norepinephrine
PE	Phenylephrine
%	Percentage
CSF	Cerebrospinal Fluid
SA	Spinal anaesthesia
>	more than
NIBP	Non-invasive blood pressure
IABP	Invasive Arterial Blood Pressure
ASA	American Society of Anaesthesiologists
MAP	Mean Arterial Pressure
CI	Cardiac Index
HR	Heart rate
VP	Vasopressin
SBP	Systolic Blood Pressure
BP	Blood Pressure
RIBP	Radial intra-arterial Blood Pressure
ICU	Intensive Care Unit
IASBP	Intra-arterial Systolic Blood Pressure
IADBP	Intra-arterial Diastolic Blood Pressure
SpO_2	Peripheral oxygen saturation
mcg	Micrograms

ABSTRACT

INTRODUCTION: Spinal anaesthesia is frequently used for lower extremity surgeries. Sympathetic blockade after spinal anaesthesia results in venodilation which reduces venous return, thus resulting in hypotension. Therefore, prophylactic use of alpha-adrenergic agonist drugs is recommended. By inducing constriction of compliant veins, they effectively reverse the vasodilatory effects of spinal anaesthesia.
In this study we compared the effect of using prophylactic Norepinephrine versus Phenylephrine infusion for prevention of spinal induced hypotension in elderly population undergoing hip and femur surgeries.

AIM of STUDY: To study the safety and efficacy of Norepinephrine and Phenylephrine infusion in prevention of Subarachnoid block induced hypotension in elderly patients posted for hip and femur surgeries.

MATERIALS AND METHODS: A randomized controlled trial was conducted on 134 elderly patients (> 60 years of age) undergoing hip and femur surgeries under spinal anaesthesia. An arterial line was secured using a 20 G arterial cannula in the radial artery. The patients were equally divided into two groups: Group NE receiving infusion Norepinephrine (8 micrograms/ml) and Group PE receiving infusion Phenylephrine (100 micrograms/ml) which was started before giving sub arachnoid block to the patient . Monitoring of invasive arterial blood pressure was done for the first 45 minutes after subarachnoid block and readings noted. The incidence of hypertension, hypertension, bradycardia and the total amount of drug used were our main outcomes.

RESULTS: The trends in invasive systolic blood pressure show that the incidence of hypotension was comparable in the two groups with 25.4% incidence in Group NE and 29.8% in Group PE. The number of patients who experienced episodes of hypertension were 28 (20.8%), all of whom belonged to Group NE. The difference was statistically significant with a p-value of 0.001. The intraoperative trends of heart rate were comparable for both the study groups with no episode of bradycardia in either of the group. Significantly lower amount of drug was used in Group NE [38.3 mcg (+/-14.27)] as compared to Group PE [51.21 mcg (+/-9.93)].

CONCLUSION: Both Norepinephrine and Phenylephrine infusions are equally efficacious in prevention of spinal induced hypotension in elderly patients posted for hip and femur surgeries. However, the Norepinephrine infusion was associated with more episodes of hypertension, whereas Phenylephrine infusion provided better hemodynamic stability during the study.

KEYWORDS: Hip and femur surgeries, Hypotension, Norepinephrine, Phenylephrine, Spinal Anaesthesia, Invasive arterial blood pressure

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INTRODUCTION

Elderly patients - belonging to age 60 years and above are twice or thrice more likely to undergo orthopaedic surgery as compared to younger patients. Bone fractures in elderly patients are called Geriatric fractures. The occurrence is much more common in females. Infact , around 50 % of females and one-third of the male elderly patients will suffer a major osteoporotic fracture after 65 years of age . The most prevalent fracture in the old age population is the hip fracture. The incidence of hip fractures increases with age, doubling for each decade after 50 years. 21% of total femur fractures are seen in 70 to 75 years old age group [1] and are related to high morbidity and mortality in these patients requiring immediate surgical intervention with long hospital stay. Advancing age and osteoporosis with lower bone mass density are important risk factors of geriatric fractures. 90 % of all hip fractures in the old age population occur as a result of fall [1]. Older people are more likely to suffer from a fall because they may have balance problems, muscle weakness and vision loss. This increased risk of trauma due to fall along with weak bones make the older age group susceptible to geriatric fractures especially hip and femur, thus requiring fracture repair surgeries.

Spinal anaesthesia is frequently used for lower extremities surgeries. It is provided by injecting local anaesthetic drugs into CSF at L3-L4 interspinal levels to achieve sensory and motor blockade of the lower limbs. This is termed as sub-arachnoid block as the drug is delivered in the sub-arachnoid space. It is the technique of choice for providing anaesthesia for hip and femur fracture repair surgeries.

Hypotension is the most common side effect of spinal anaesthesia. Intraoperatively, hypotension is mostly defined as systolic blood pressure below 80% of the baseline value. It is frequently encountered in obstetrics

and elderly patients. Block of pre-ganglionic sympathetic fibres located in the subarachnoid space during subarachnoid anaesthesia causes a decrease in the systemic vascular resistance, secondary to arteriolar and venous dilation, with subsequent blood pooling in the body areas under the spinal block inducing systemic hypotension [2]. The resulting venodilation reduces venous return, reducing pre-load and hence cardiac output and further contributes to hypotension. Thus, the main mechanism resulting in spinal induced hypotension is the sympathetic blockade followed by arterial dilatation with a reduction in vascular resistance.

In elderly, the incidence of hypotension post spinal anaesthesia can be as high as 73%[3]. Spinal anaesthesia induced hypotension has more calamitous effects in this old age population as compared to their younger counterparts.

The effect of hypotension is more debilitating in elderly age group due to decreased physiological reserve and blunted cardiac reflexes. Aging is related with sympathetic nervous system deregulation, which includes cardiac and vascular beta-adrenergic receptors [4]. Beta-adrenergic receptor - induced vasorelaxation decreases with age. This results in age related cardiovascular impairment [5]. The physiologic hemodynamic reserve capacity decreases with age, and limited cardiovascular compensation mechanisms contribute to a decline in cardiac output [4].

In the old age population, the mechanism of hypotension differs from that in young adults, as it is mainly caused by a reduced stroke volume rather than a decrease in the systemic vascular resistance [6]. Geriatric patients frequently present with long standing hypertension and various other comorbidities, making them more prone to postoperative complications resulting from intraoperative hypotension which can lead to fatalities. It exposes this vulnerable age group to reduced organ perfusion increasing the risk of perioperative morbidity and mortality [7, 8].

Hence, there is a need for early prevention and/or prompt treatment when hypotension occurs.

Fluid loading in the form of crystalloids has long been advocated as a measure of prophylaxis against spinal induced hypotension. Advancing age is associated with compromised blood supply to vital organs, and change in circulatory volume, resulting in a disposition to congestive heart failure following fluid administration [9]. Risk of crystalloid administration induced volume overload is high in patients with pre-existing co-morbidities like hypertension, diabetes, coronary artery disease, metabolic syndrome, cardiomyopathy and patients with lower ejection fractions.

AJ Cole et al, in their study , compared crystalloid pre-loading with Ringer Lactate at 16 ml/kg, 8 ml/kg and no volume and found that incidence of intraoperative hypotension requiring treatment was similar in all three groups , hence suggesting crystalloid loading is often not effective in maintaining blood pressure[9].

Langesaeter et al established that the lack of effectiveness of intravenous fluid loading following subarachnoid block was because of a sympathetic block which is associated with decreased vascular resistance in the peripheral circulation, including a decrease in arterial tone [10]. Hence, vasopressors came into practice to counteract the decrease in peripheral vascular resistance and increase in stroke volume

Prophylactic use of alpha-adrenergic agonist drugs is recommended which act by inducing constriction of compliant veins[11], effectively reversing the vasodilatory effects of spinal anaesthesia.Vasopressors are routinely used to counteract hypotension after neuraxial anaesthesia. Preventive use of vasopressor infusions, started synchronously with spinal block can ameliorate and/or minimise spinal-anaesthesia induced hypotension. In addition, its use also reduces the need for unnecessary fluid loading [12] which can be of additional advantage in the elderly age group with compromised cardiovascular functioning. The understanding of

the mechanism of hypotension and the choice of vasopressor has evolved over the years, but there is no conclusive evidence showing definitive clinical benefit of one vasopressor over the other. The choice of vasopressors lies between using a mixed alpha and beta adrenoceptor agonist or a pure alpha adrenoceptor agonist.

Various vasopressors have been used for the prophylaxis of spinal induced hypotension with Ephedrine, Phenylephrine and Norepinephrine being the most commonly used and extensively studied.

Critchley et al. studied the role of Ephedrine and concluded that using it alone was not always effective in maintaining systolic arterial pressure, especially when used in the elderly patients [13].

In the past Phenylephrine was commonly used for the management of spinal-induced hypotension. Phenylephrine is a synthetic alpha-agonist vasoconstrictor [3]. It has been the first choice for elective cesarean section deliveries and has also been evaluated in elderly patients. However, Phenylephrine (being a pure alpha-agonist) was reported to decrease heart rate and cardiac output [14], which limits its use in patients with reduced cardiac contractility; this fact makes the use of Phenylephrine in elderly patients questionable [2]. Recently, Norepinephrine has been described as an effective alternative to phenylephrine for the prevention and treatment of hypotension during SA for cesarean delivery. Norepinephrine is an alpha-agonist with weak beta-agonist activity, thus, in addition to its vasoconstriction properties, Norepinephrine has modest cardiostimulatory function[15] compared to Phenylephrine. Norepinephrine has been successfully evaluated for prophylaxis against spinal anaesthesia induced hypotension in obstetric anaesthesia[16].

Relatively few studies have evaluated the effectiveness of continuous infusion of Norepinephrine in preventing intra-operative hypotension in older patients and even fewer have compared both Norepinephrine and

Phenylephrine to evaluate the better agent for prevention of spinal induced hypotension.

MC Vallejo et al. performed an open label randomised controlled clinical trial comparing continuous infusions of Norepinephrine and Phenylephrine in cesarean delivery and results showed that both regimens were effective with similar requirement for rescue boluses and hence they concluded that Norepinephrine can be used as an alternative to Phenylephrine[17].

M Mostafa et al. conducted a randomized controlled trial on 62 elderly (>70 years) patients scheduled for hip fracture surgeries comparing hemodynamic effects of Norepinephrine with Phenylephrine infusion for prophylaxis against spinal induced hypotension using Non Invasive Blood Pressure (NIBP) monitoring. The authors compared that though both the vasopressor agents effectively prevented spinal induced hypotension , Norepinephrine provided more hemodynamic stability than Phenylephrine , maintaining heart rate , higher cardiac output , less reactive bradycardia and hypertension[2]. Hypotension has been defined as a systolic blood pressure below 80% of baseline value.

However, in the previous studies, routinely non invasive blood pressure monitoring has been used, although, invasive arterial blood pressure (IABP) monitoring is the gold standard technique [18].

In this study we aim to compare the effect of using prophylactic Norepinephrine versus Phenylephrine infusion for prevention of intraoperative hypotension after spinal anaesthesia in elderly population undergoing hip and femur surgeries using invasive arterial blood pressure monitoring.

AIM AND OBJECTIVE

- To study the effect of prophylactic infusion of Phenylephrine and Norepinephrine on prevention of hypotension using invasive technique for blood pressure monitoring.

REVIEW OF LITERATURE

Spinal anaesthesia also called subarachnoid block is a form of neuraxial regional anaesthesia involving injection of a local anaesthetic into the subarachnoid space at L3-L4 vertebral space. It is frequently used for lower extremity surgeries. The lower extremity surgeries account for 24% of all interventions among patients aged 65 years and above. Sub - arachnoid block has been the first choice technique for anaesthesia for these surgeries

The local anaesthetic with or without an opioid injected into the cerebrospinal fluid provides locoregional anaesthesia: true analgesia, motor, sensory and autonomic (sympathetic) blockade.

Hypotension following subarachnoid block is extremely common. In the eldelry age group patients, especially, this intra - operative hypotension can prove to be a very serious complication with perilous consequences.

Therefore, it becomes crucial to take steps to deter hypotensive episodes, more importantly, in the geriatric patients .There are various strategies recommended as prophylactic measures to prevent and treat this spinal anaesthesia induced hypotension.

Non-pharmacological techniques include physical interventions like the Trendelenburg's position, delayed supine positioning post spinal anaesthesia . The use of intravenous fluid administration in the form of crystalloid preload, colloid preload or crystalloid co-load has been in practice since time immemorial. However majority were found to be non efficacious.

A J Coe et al. reported that in sixty ASA I-II patients, aged 60 years or above scheduled for lower limb surgeries under spinal anaesthesia allocated randomly in 3 groups A, B and C receiving crystalloid preloading with ringer's acetate solution at 16 ml/kg, 8 ml/kg and no volume preload respectively, the incidence of systolic hypotension requiring treatment was similar in all three groups [9].

Langesaeter et al. established that the lack of effectiveness of intravenous fluid loading following subarachnoid block was due to a sympathetic block which is associated with decreased peripheral vascular resistance, including a decrease in arterial tone [10].

Hence vasopressors came into practice to counteract the decrease in peripheral vascular resistance and increase stroke volume and manage the hypotension occurring as a consequence of subarachnoid block. The choice of vasopressors lies between using a mixed alpha and beta adrenoceptor agonist or a pure alpha adrenoceptor agonist.

Ephedrine, a mixed alpha+beta agonist, has been widely used [13].

However, work by Critchley et al. on the utilisation of ephedrine during administration of subarachnoid block in geriatric patient group showed that ephedrine alone, in clinically used dosages, was not always effective in maintaining systolic arterial pressure, failing in 10 out of 27 patients. This was due to the inability of ephedrine to correct the decrease in total peripheral resistance. The apparent lack of peripheral vasoconstrictive activity of ephedrine was probably a consequence of its beta activity. It was also suspected that old age patients, because of their decreased physiological reserve, were less capable of responding to ephedrine by increasing their cardiac output [13].

T. Taivainen et al. studied thirty ASA II-III patients (>65 years) undergoing hip surgery under spinal anaesthesia and compared ephedrine and etilefrine for the treatment of arterial hypotension during spinal anaesthesia and deducted that a marked reduction of blood pressure was successfully treated with ephedrine 0.07 mg/kg or etilefrine 0.03 mg/kg with ephedrine being somewhat more potent than etilefrine[19].

Zunic et al. studied the influence of the infusion of ephedrine and phenylephrine on the hemodynamic stability after subarachnoid anaesthesia in senior adults. The study groups were compared on the basis of changes in Mean Arterial Pressure (MAP), Cardiac Index (CI) and Heart Rate (HR). The conclusions derived suggested hemodynamic

changes after SAB in eldery patients posted for orthopedic surgery can be prevented by an immediate infusion of phenylephrine or ephedrine, use of ephedrine was associated with an increase in CI and HR while phenylephrine maintained a normal range of the two parameters [20].

A Rahman et al performed a comparative study evaluating the prophylactic effect of phenylephrine and ephedrine on hypotension during spinal anesthesia for hip fracture surgery. They studied 92 adult patients posted for hip fracture repair under spinal anaesthesia, who were randomized to receive prophylaxis with intravenous 10 mg bolus of ephedrine or intravenous 50 mcg bolus of phenylephrine immediately before the spinal anesthesia and recorded mean arterial pressure (MAP), systolic and diastolic blood pressure, heart rate every 3 min for the first 10 min and then every 5 min until 30 min after intrathecal injection, nausea and vomiting, additional vasopressor, and atropine administration. They proposed that, in their study, the frequency of hypotension in terms of MAP, systolic and diastolic pressure was significantly lower in group phenylephrine at 3, 6, and 9 min after spinal anesthesia. In addition, in the phenylephrine group, lower additional vasopressor was used [21].

Vasopressin is a nonapeptide antidiuretic hormone involved in modulating various physiological processes, including autonomic signalling, stress response, behaviour, and memory; the most well-known modulation is of blood pressure. Vasopressin acts both within the brain and in the periphery to modulate blood pressure through sympathetic outflow, baroreflex modulation, vasoconstriction, and renal fluid retention. Vasopressin has found limited use for prophylaxis of spinal induced hypotension.

However, Braun et al. reported a case where a patient with severe primary pulmonary hypertension underwent skin grafting for a leg ulcer under subarachnoid block with an intravenous infusion of vasopressin, and documented that use of VP infusion prevented systemic hypotension resulting from sympathetic blockade while avoiding increases in

pulmonary vascular resistance, which may result from catecholamine usage [22].

Shamshery et al. reported that in patients who underwent abdomen and lower limb surgeries under neuraxial blockade, mean arterial blood pressure values were significantly lesser in patients in a control group during the preliminary 14 min as compared to patients who received VP infusion [23].

The most popular vasopressor agents employed for maintenance of intraoperative blood pressure after intrathecal injection are Norepinephrine and Phenylephrine. Phenylephrine exclusively acts on alpha receptors causing peripheral vasoconstriction and thus increase BP [24].

Phenylephrine has been extensively studied in obstetric population and has been considered the go to vasopressor agent in cesarean deliveries. Warwick D Ngan Kee et al. studied the combination of Phenylephrine infusion and crystalloid cohydration in 106 pregnant women and concluded that this is an effective technique for preventing hypotension in cesarean sections under spinal [25].

In 2013, M. Heesan et al. published a systematic review and meta-analysis on prophylactic use of Phenylephrine for cesarean section under spinal anaesthesia. They used meta-analysis in order to evaluate prophylactic Phenylephrine infusion as compared with placebo, infusion of Ephedrine and both combined. After studying 21 RCTs with 1504 participants, the authors reported that using Phenylephrine infusion decreased the occurrence of intraoperative hypotension post spinal for cesarean section and also reduced the incidence of postoperative nausea and vomiting[26].

More research studying the effect of employing Phenylephrine in patients undergoing surgery under spinal anaesthesia have encouraged it's use in all surgeries where intrathecal injection is administered.

Phenylephrine use has been found to be associated with increased incidence of bradycardia. Recent research work has focused on the potential of Norepinephrine as an alternate vasopressor to Phenylephrine in cesarean and other surgeries under subarachnoid block. Norepinephrine, in addition to its stimulatory action on alpha receptors, also acts as a beta agonist which prevents bradycardia[27].

A Mohamed et al. performed a placebo - controlled study comparing utilisation of continuous Norepinephrine infusion with Vasopressin for avoidance of spinal induced hypotension. They randomly allocated 240 young patients into 3 equal groups: Group C who received plain saline infusion, Group NE who received Norepinephrine infusion (0.1 mg/ml; 3 ml/h) and Group VP who received Vasopressin infusion (0.5 U/ml; 1 U/h) and measured systolic blood pressure and heart rate for 30 minutes post administration of sun arachnoid block. The results revealed that throughout the 30 min after intrathecal injection, all systolic BP and HR measures in patients receiving plain saline infusion were significantly less in comparison to their baseline values and with corresponding measures of patients who received vasopressor infusions, with a comparable values between the NE and VP groups .No patient in the NE and VP groups saw reduction in systolic blood pressure of > 10%.

Both Phenylephrine and Norepinephrine are considered better alternatives to ephedrine in obstetric cases as well as in elderly patients posted for surgery under spinal anaesthesia[28].

Ngan Kee et al. in 2015 compared the computer controlled variable rate infusion of norepinephrine and phenylephrine to maintain SBP. After induction, measurements were taken at 1 minute intervals till delivery. Primary outcome compared was cardiac output. The authors observed that a computer controlled infusion of norepinephrine maintained blood pressure as effectively as phenylephrine but with less bradycardia and less decrease in cardiac output [14].

Chen, Z., Zhou, J., Wan, L. et al., in their study where Norepinephrine and Phenylephrine infusions were evaluated for prophylaxis of post spinal hypotension during cesarean section for twin pregnancy, concluded that use of Norepinephrine infusion was not associated with any change in incidence of change in heart rate but a better control of blood pressure was achieved as compared to Phenylephrine[29].

Hasanin, A et al. compared infusion of Norepinephrine with phenylephrine for prevention of post spinal anaesthesia hypotension during elective cesarean delivery and the results showed that infusion Norepinephrine more effectively maintained maternal systolic blood pressure with less incidence of reactive hypertension and bradycardia compared to phenylephrine[30].

MC Vallejo et al. performed an open label randomised controlled clinical trial comparing continuous Norepinephrine and Phenylephrine infusions in preventing spinal hypotension during cesarean sections and results showed that both regimens were effective with similar requirement for rescue boluses and hence they concluded that Norepinephrine can be used as an alternative to Phenylephrine[17].

M Mostafa et al. conducted a randomized controlled trial on 62 elderly (>70 years) patients scheduled for hip fracture surgeries comparing hemodynamic effects of norepinephrine and Phenylephrine infusion for prophylaxis of hypotension due to spinal anaesthesia. Elderly patients scheduled for hip fracture surgery were randomized into two groups - Norepinephrine: group NE receiving Norepinephrine 8 micrograms/min and Phenylephrine: group PE receiving Phenylephrine 100 micrograms/min - (31 patients each). The outcomes included mean heart rate, mean blood pressure, cardiac output, incidence of spinal anaesthesia-induced hypotension, incidence of bradycardia, and incidence of hypertension. The authors compared that though both Norepinephrine and Phenylephrine infusions effectively prevented spinal anaesthesia induced hypotension, Norepinephrine provided more

hemodynamic stability than Phenylephrine , maintaining heart rate, higher cardiac output , less reactive bradycardia and hypertension[2].

A recent randomised control trial by H Kim et al. evaluated the use of Norepinephrine infusion for preventing hypotension in older patients under spinal anaesthesia with intravenous propofol sedation. For the study they took 67 patients and divided them into a Norepinephrine group (Group N) where infusion Norepinephrine was given and a control group (Group C) where continuous saline infusion was given and the results showed that the number of hypotensive episodes during surgery were significantly higher in Group C than in Group N. The number of patients who experienced one or more hypotensive episodes during surgery was also greater in Group C premising that continuous Norepinephrine infusion following spinal anaesthesia effectively reduces the episodes of hypotension intra - operatively [31].

Most of the studies comparing vasopressor infusions for prophylaxis of hypotension post sub arachnoid block have used non-invasive techniques for monitoring blood pressure. There is conclusive evidence that invasive intra arterial blood pressure monitoring is the gold standard technique for measurement of blood pressure values in patients. A research comparing measurement of MAP using automatic oscillometers, invasive intra-arterial and auscultation was conducted by A J Rutten et al. in 1986. They determined mean artery pressure by using five seperate non-invasive oscillometric and one auscultatory preferred (oscillometric back-up) BP monitors and compared with MAP obtained by invasive through radial artery cannula insertion in the arm on the same side. They concluded that the automatic oscillometric blood pressure monitors tested showed accuracy comparable to BP measurement by auscultation, and are acceptable for routine use in the appropriate clinical context. However, in settings where individual BP readings have importance rather, or where an increased degree of accuracy is needed, automatic oscillometric

machines cannot be regarded as satisfactory alternatives to arterial cannulation[32].

Recently, a study by M R Rebesco et al was published in October 2020 where they compared non-invasive blood pressure recording strategies with invasive measurement. They selected adult intensive care unit (ICU) patients with invasive catheters placed in radial arteries to measure radial intra-arterial blood pressure (RIBP) as a part of their routine care at a large, urban, Level I trauma center. SBP was taken by three different NIBP techniques (oscillometric, auscultated, and palpated) and compared to RIBP measurements. Conclusions drawn from the study suggest that overall, NIBPs significantly under-estimated RIBP measurements. Palpated BP measurements were consistently lower than RIBP, which was statistically and clinically significant. According to their report these results raise concern about the accuracy of palpated BP and its pervasive use in prehospital care [18].

Thus, for our study, we proposed the use of invasive intra arterial blood pressure monitoring as the technique of choice for obtaining intraoperative blood pressure values.

MATERIAL AND METHOD

SOURCE OF DATA:

A randomized control trial and study was conducted in the Department of Anaesthesiology, Dayanand Medical College & Hospital, Ludhiana after approval by the Institutional Ethics Committee on a total of 134 elderly patients (age group > 60 years) undergoing hip and femur surgeries under subarachnoid anaesthesia. A written informed consent was obtained from the patients.

METHODOLOGY:

Inclusion criteria:

Elderly patients (>60 years) undergoing hip and femur surgeries.

Exclusion criteria:

Patients with a history of allergy to any of the study drugs.
Patients with contra-indications for spinal anaesthesia.
Patient refusal.

GROUP ALLOCATION

A total of 134 elderly (>60 years of age) patients were included in the study who were randomly allocated into 2 groups named NE and PE. Randomisation was carried out using a computer generated random number sequence.

GROUP NE (Norepinephrine group)

A total of 67 patients in group NE received prophylactic Norepinephrine infusion.

GROUP PE (Phenylephrine group)

A total of 67 patients in group PE received prophylactic Phenylephrine infusion.

TECHNIQUE:

Preanaesthetic checkup -

All patients underwent routine thorough pre-anaesthesia checkup one day prior to surgery comprising of detailed history, comorbidities, allergy to any drug being used along with general, systemic and airway examination. Relevant routine investigations required were noted. Patients and their attendants were explained about the study being conducted and written informed consents were taken.

Anaesthesia technique -

The study was conducted on elderly patients posted for hip and femur surgeries. Pre-operative non invasive blood pressure (NIBP) was measured. Patients were kept fasting as per the standard guidelines for fasting before surgery.

The premedication given to the patient was noted. After arrival in the operating room, monitors were attached to the patient and standard monitoring in the form of five lead ECG, Heart Rate (HR), non-invasive blood pressure (NIBP), oxygen saturation (SpO2) was done and recorded and baseline hemodynamic measurement noted.

Two 20 G intravenous cannula were secured. An arterial cannula of size 20 G was inserted into the radial artery of the patient under local anaesthesia. Arterial line monitoring was started and baseline value noted by anaesthesiologist. Fluid administration was done using balanced salt solution at the rate of 100 ml/hr. A solution of either Norepinephrine 8

micrograms/ml (prepared by diluting 4 mg NE in 500 ml saline) or phenylephrine 100 micrograms/ml (prepared by diluting 10 mg of PE in 100 ml saline) was started in a 20 G cannula other than the one used for IV fluids at a rate of 60 ml/hour. These concentrations of study solutions were chosen based on potency ratio 13:1 (Norepinephrine: Phenylephrine) as determined in previous clinical studies. The drugs were prepared in isotonic saline in 50 ml syringes that were labeled as “study solution” and administered through pressure tubing to the intravenous cannula. Randomisation was according to the computer generated randomisation codes contained in sealed, sequentially numbered envelopes. Both patients and observer were blinded to the nature of the study solution being administered.

Patients were positioned in a sitting position and subarachnoid block was administered to the patient under all aseptic precautions. After skin infiltration with lignocaine hydrochloride 2% [w/v], a 26-gauge Quincke”s spinal needle was inserted in the L3 to L4 vertebral interspace. After confirmation of free flow of cerebrospinal fluid, a total of 2.2 ml of volume of bupivacaine 0.5% (1.7 ml) with 25 micrograms (0.5 ml) of fentanyl was injected intrathecally and patients were returned back to supine position. Supplemental oxygen at the rate of 5 L/minute using a venturi mask was given to all patients. If spinal anaesthesia failed, the patient was excluded from the study and managed according to the attending anaesthesiologist's discretion.

The IABP monitoring was started before intrathecal injection after the patient is laid down in supine position and reading was observed and noted at 2 minute intervals until 45 minutes of after subarachnoid block
From the start of intrathecal injection until 45 minutes of subarachnoid block, study solution infusion was regulated according to the IABP,

keeping the target as 100% of baseline SBP. The infusion rate was regulated as follows:

The infusion of study solutions was initiated at the rate of 60 ml/hour. Hypotension was defined as SBP<80% of baseline or an absolute value of less than 100 mmHg and the number of such episodes will be recorded. If SBP is <80% of baseline , it was managed by 4 micrograms of Norepinephrine or 10 micrograms of Phenylephrine , and the infusion rate was increased by 20%. If SBP continued to be <80% of the baseline for 2 minutes, we administered another rescue bolus of NE. Episodes of hypertension (defined as an SBP level of >120%) was also recorded. If hypertensive episodes persist for 2 minutes, they were managed by reducing the infusion by 50%. If hypertension persists after reduction of the infusion rate, the vasopressor infusion was stopped. The vasopressor was resumed at 50% of the starting dose if there was a further decline in blood pressure. The total number of rescue boluses given and total volume of study solution given via the syringe pump up till the end of surgery was recorded. Bradycardia was defined as HR<50 beats per minute [bpm], and was treated by stopping the study solution if associated with SBP more than or equal to baseline. Bradycardia associated with SBP less than baseline was treated with intravenous atropine 0.6 mg. The study was discontinued after 45 minutes of subarachnoid block and the study solution was then continued on the discretion of the attending anaesthesiologist.

FOLLOWING OUTCOMES WILL BE OBSERVED:

PRIMARY OUTCOME

Episodes of hypotension (defined as SBP<80% of baseline or an absolute value of less than 100 mmHg).

SECONDARY OUTCOME

Total amount of Phenylephrine/Norepinephrine used till 45 minutes after subarachnoid block.

Episodes of Bradycardia.

Incidence of hypertension.

The following observations will be recorded to analyse the above mentioned outcomes: SBP, DBP, MAP, HR, and SpO 2 - baseline values and then at regular intervals of 1 minute till the end of surgery.

OBSERVATION AND RESULTS

This randomized double blind observational study was conducted in the department of Anaesthesiology Dayanand Medical College and Hospital Ludhiana on a total of 134 patients aged 60 years and above posted for hip and femur surgeries under sub arachnoid block. The patients were randomly allocated into either of the two study groups of 67 each by a computer generated randomisation codes contained in sealed, sequentially numbered envelopes

- **GROUP NE (Norepinephrine group)**

A total of 67 patients in group NE received prophylactic Norepinephrine 8 micrograms/ml in a manually controlled infusion rate titrated to our protocol starting at 60 ml/hour, targeting maintenance of SBP at 100% of baseline value.

- **GROUP PE (Phenylephrine group)**

A total of 67 patients in group PE received prophylactic Phenylephrine 100 micrograms/ml in a manually controlled infusion rate titrated to our protocol starting at 60 ml/hour, targeting maintenance of SBP at 100% of its baseline value

1. Demographic Data

Table 1.1: Distribution of patients according to gender

		Group NE		Group PE		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
GENDER	FEMALE	32	47.8%	34	50.7%	66	0.119	0.730
	MALE	35	52.2%	33	49.3%	68		
Total		67	100.0%	67	100.0%	134		

The demographic data in terms of gender of patients enrolled in the study was comparable among both the study groups. Of the total 134 patients, 66 patients were females and 68 patients were males.

Total 32 females (47.8%) and 35 males (52.2%) were allocated Group NE whereas 34 females (50.7%) and 33 males (49.3%) were allocated in Group PE.

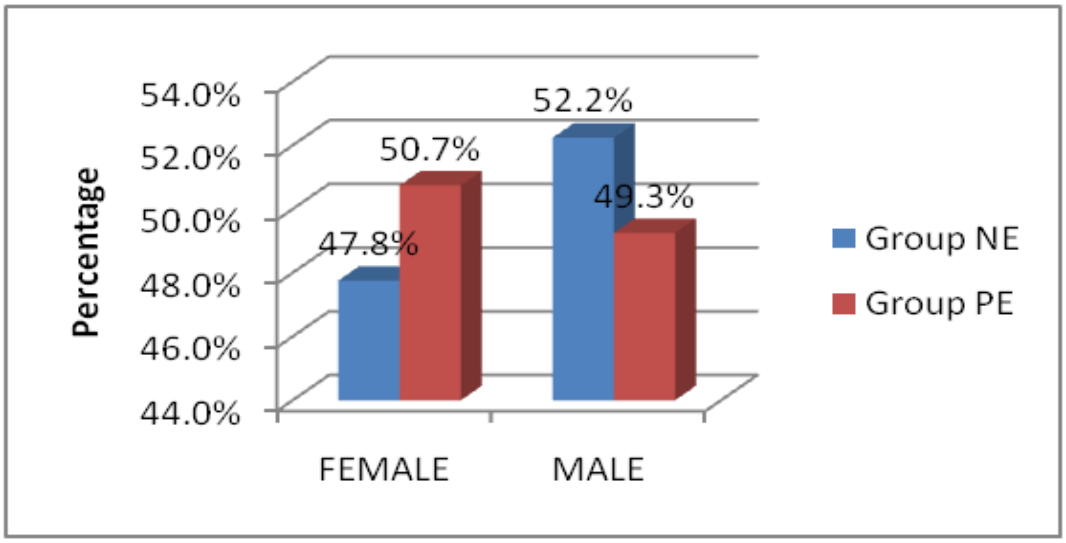

Figure 1: Distribution of patients according to gender

Table 1.2: Distribution of patients according to age

	Group NE		Group PE		t	p-value
	Mean	SD	Mean	SD		
AGE (years)	74.85	10.18	71.63	9.07	1.963	0.055

The demographic profile for age showed no significant difference between age of patients in either of the groups. The mean age for Group NE was 74 (+/- 10) years and for Group PE the mean age was 71 (+/- 9) years.

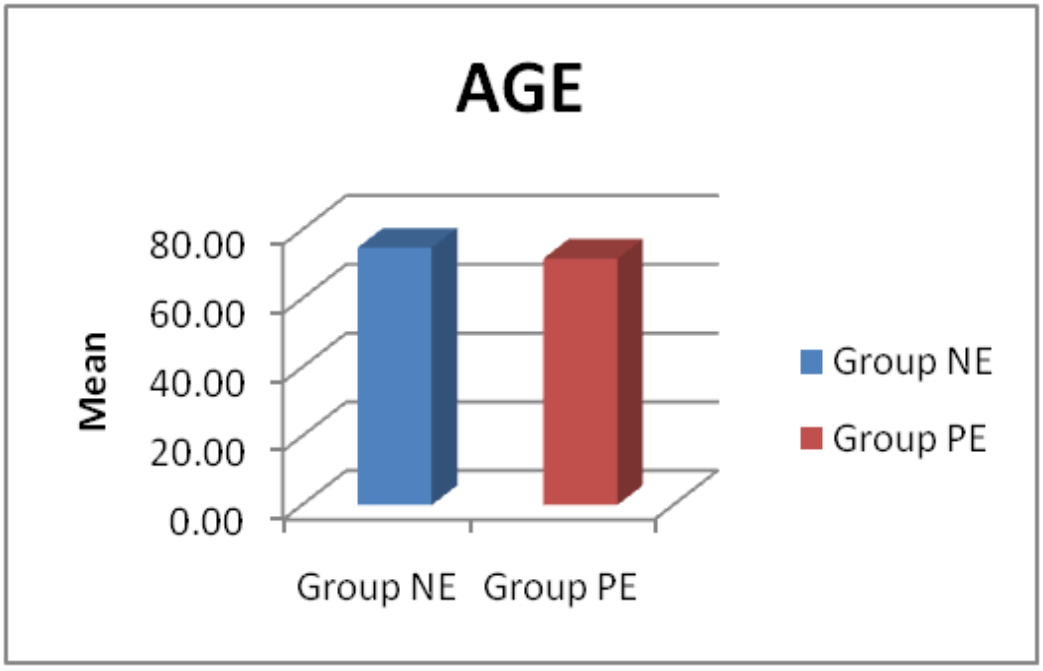

Figure 2: Distribution of patients according to age

Table 1.3: Distribution of patients according to ASA Grade

		Group NE		Group PE		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
ASA Grade	I	1	1.5%	3	4.5%	4	2.382	0.497
	II	24	35.8%	27	40.3%	51		
	III	41	61.2%	37	55.2%	78		
	IV	1	1.5%	0	0.0%	1		
Total		67	100.0%	67	100.0%	134		

The distribution of patients according into their respective ASA Grades (I to IV) was similar in both the study groups

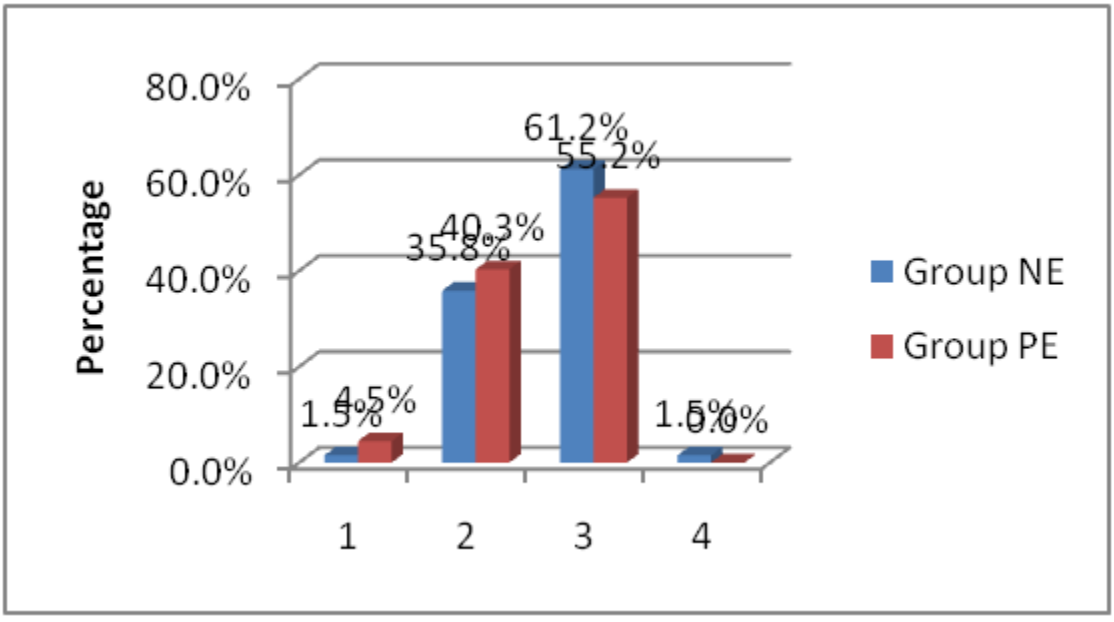

Figure 3: Distribution of patients according to ASA Grade.

2. Baseline Heart Rate (HR)

Table 2: Baseline Heart Rate (HR)

Heart Rate	Group NE		Group PE		Z	p-value
	Mean	SD	Mean	SD		
HR_1 Min	81.54	11.33	80.58	10.03	-0.409	0.683
HR_2 Min	81.72	11.27	80.88	9.50	-0.232	0.817
HR_3 Min	82.07	11.68	80.67	10.15	-0.459	0.646
Mean HR	81.79	11.28	80.67	9.66	-0.437	0.662

Mean value of baseline heart rate was calculated in both the groups by taking three consecutive baseline values for all patients included in the study. The mean heart rate for Group NE was 81 (+/- 11) and for Group PE was 80 (+/- 9). These were comparable among both the study groups.

Figure 4: Mean Heart Rate (HR)

3. Trends in Intraoperative Heart Rate (HR)

Table 3: Intraoperative Heart Rate trends

Heart Rate	Group NE		Group PE		Z	p-value
	Mean	SD	Mean	SD		
HR_2 Min	80.97	11.30	81.27	9.82	-0.535	0.593
HR_4 Min	80.82	11.36	80.79	10.62	-0.461	0.645
HR_6 Min	80.90	11.35	79.70	10.97	-0.384	0.701
HR_8 Min	80.72	11.22	79.57	10.41	-0.250	0.803
HR_10 Min	80.36	11.07	79.75	10.56	-0.018	0.986
HR_12 Min	80.79	10.73	79.45	10.30	-0.739	0.461
HR_14 Min	80.84	10.88	79.63	10.80	-0.862	0.388
HR_16 Min	81.04	11.00	79.63	10.96	-0.720	0.472
HR_18 Min	81.90	10.67	80.57	11.11	-0.760	0.448
HR_20 Min	82.45	10.84	80.76	11.30	-0.864	0.387
HR_22 Min	81.87	11.33	80.36	10.84	-0.472	0.637
HR_24 Min	81.55	11.47	80.22	10.20	-0.708	0.480
HR_26 Min	81.51	11.04	80.19	9.90	-0.622	0.534
HR_28 Min	81.01	10.19	80.49	9.82	-0.283	0.777
HR_30 Min	81.01	10.20	80.82	10.08	-0.105	0.917
HR_32 Min	80.85	10.56	80.82	9.37	-0.544	0.586
HR_34 Min	81.07	10.61	81.42	9.14	-0.558	0.577
HR_36 Min	80.99	10.78	80.61	9.83	-0.078	0.938
HR_38 Min	80.78	10.34	80.64	9.51	-0.352	0.725
HR_40 Min	80.84	10.65	81.01	9.44	-0.771	0.441
HR_42 Min	80.69	11.12	80.69	9.61	-0.432	0.665
HR_44 Min	80.57	10.90	80.52	9.38	-0.368	0.713

Trends of heart rate of patients included in the study shows that there was no significant difference in the heart rate in both the study groups. The heart rate values followed a similar trend throughout the duration of study During this study, no episodes of bradycardia were seen in either of the two groups.

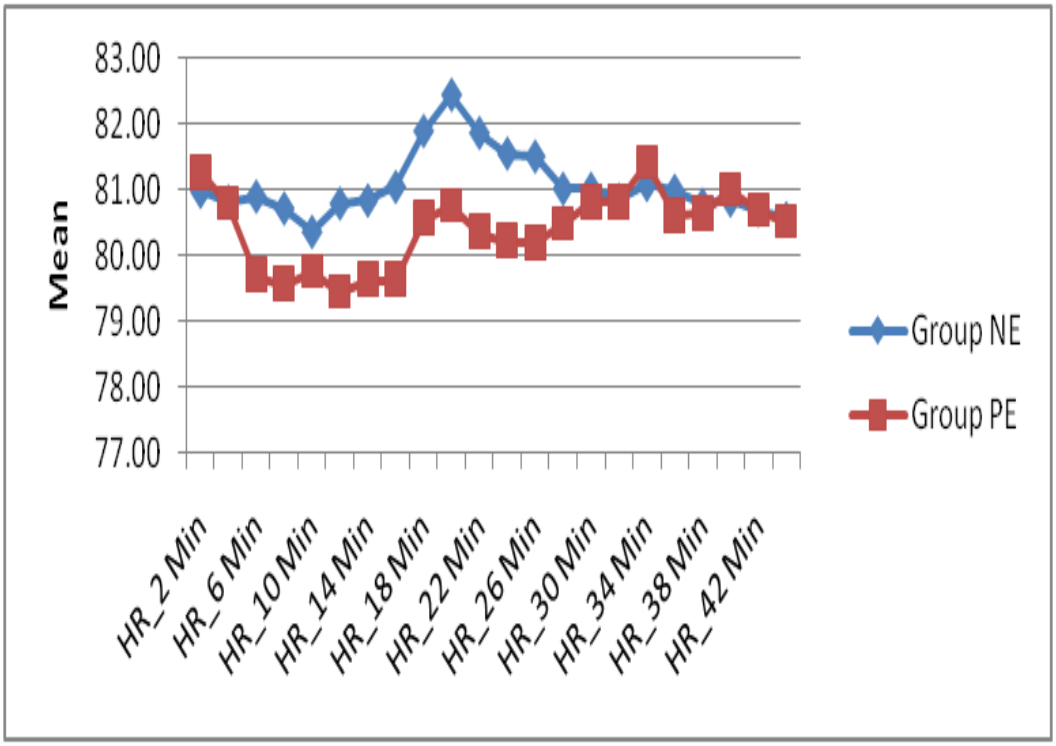

Figure 5: Trends in Heart Rate (HR)

4. Baseline Mean Intra Arterial Systolic Blood Pressure (IASBP)

Table 4: Baseline mean Intra Arterial Systolic Blood Pressure (IASBP)

SBP (mmHg)	Group NE		Group PE		Z	p-value
	Mean	SD	Mean	SD		
SBP_1 Min	136.42	17.49	138.13	16.52	-0.584	0.560
SBP_2 Min	135.78	17.50	137.66	16.35	-0.643	0.521
SBP_3 Min	135.58	17.02	138.67	16.90	-1.054	0.294
Mean SBP	135.73	17.26	137.82	16.23	-0.722	0.472
80% of SBP	108.37	13.91	109.75	13.02	-0.590	0.556
120% of SBP	162.52	20.79	166.96	19.43	-1.275	0.205

Mean value of IASBP was calculated in both the groups by taking three consecutive baseline values. Thereafter we calculated 80% and 120% of mean IASBP to derive the value of IASBP denoting hypotension and hypertension.The baseline values for IASBP and the mean IASBP which in Group NE was 135 mmHg(+/-17) for Group PE was 137 mmHg (+/-16), were comparable in both the groups.

Similar trends were seen when calculations were done for 80% and 120% of mean IASBP. The values of 80% and 120% of mean IASBP for Group NE were 108 mmHg(+/-13) and 162 mmHg (+/-20), respectively. For Group PE, the values were 109 mmHg (+/-13) and 166 mmHg (+/-19). There was statistically insignificant difference in these values in both the studies.

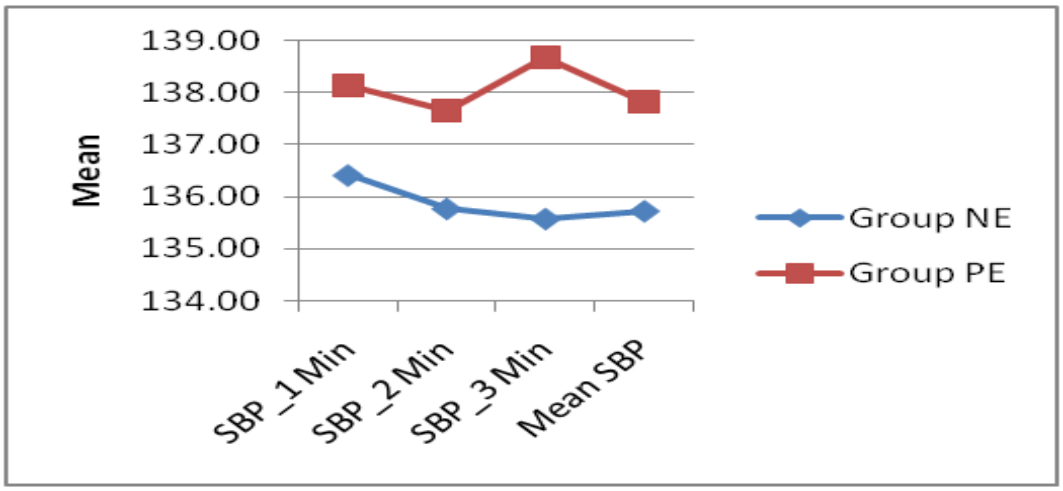

Figure 6: Mean Intra Arterial Systolic Blood Pressure

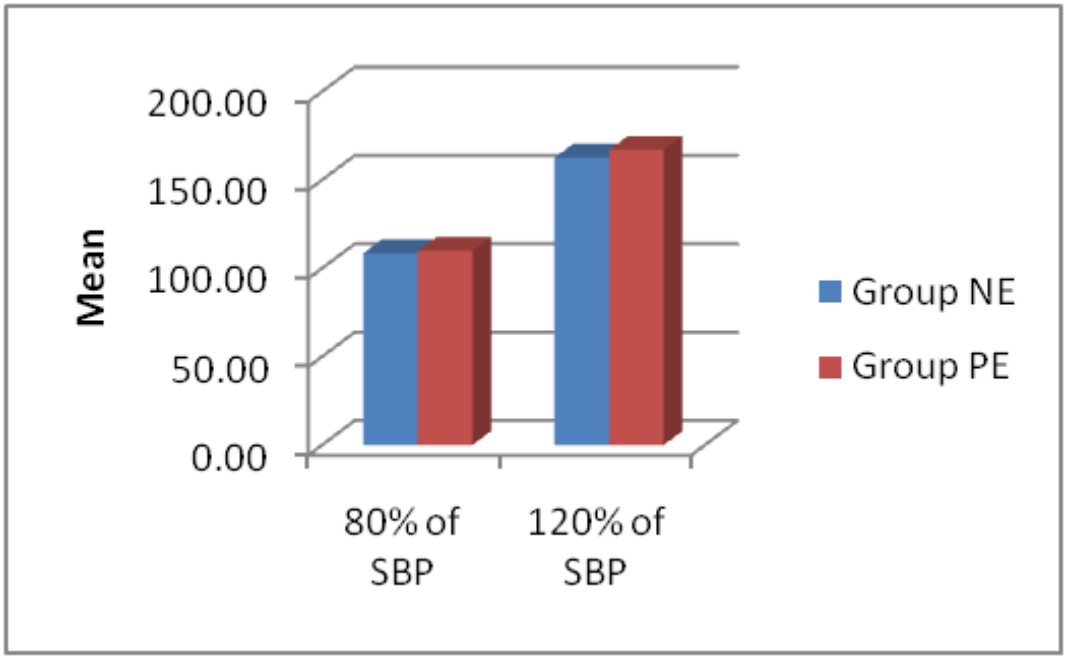

Figure 7: 80% of SBP and 120% of SBP

5. Trends in Intra Arterial Systolic Blood Pressure (IASBP)

Table 5: Intra Arterial Systolic Blood Pressure trends

IASBP (mmHg)	Group NE		Group PE		Z	p-value
	Mean	SD	Mean	SD		
IASBP_2 Min	137.01	19.94	141.46	20.28	-1.280	0.203
IASBP_4 Min	138.01	23.88	139.06	17.73	-0.768	0.442
IASBP_6 Min	138.97	24.00	134.70	15.80	-0.721	0.471
IASBP_8 Min	143.25	29.18	132.37	16.04	-2.267	0.023
IASBP_10 Min	142.10	23.50	135.43	15.46	-1.830	0.067
IASBP_12 Min	141.87	23.90	135.66	15.17	-1.476	0.140
IASBP_14 Min	141.00	21.64	135.87	15.86	-1.269	0.204
IASBP_16 Min	140.43	21.06	133.76	25.26	-1.311	0.190
IASBP_18 Min	139.94	17.64	135.79	18.67	-1.307	0.191
IASBP_20 Min	140.10	15.35	134.72	20.23	-1.372	0.170
IASBP_22 Min	137.69	14.28	138.27	14.27	-0.252	0.801
IASBP_24 Min	136.51	13.80	138.12	15.20	-0.526	0.599
IASBP_26 Min	133.76	19.54	138.93	14.35	-1.610	0.107
IASBP_28 Min	134.19	12.65	135.64	20.37	-1.330	0.184
IASBP_30 Min	134.00	13.10	137.49	13.51	-1.519	0.131
IASBP_32 Min	134.81	12.82	138.91	13.35	-1.867	0.062
IASBP_34 Min	134.31	12.80	138.33	13.45	-1.766	0.077
IASBP_36 Min	134.99	11.67	137.10	18.31	-1.411	0.158
IASBP_38 Min	134.70	11.94	140.22	13.05	-2.456	0.014
IASBP_40 Min	133.13	12.22	140.19	13.59	-2.820	0.005
IASBP_42 Min	131.64	12.72	138.09	20.85	-3.063	0.002
IASBP_44 Min	132.46	12.38	141.25	14.68	-3.225	0.001

Statistically significant differences were observed between the two groups with regard to trends of intraoperative IASBP. The values were less for

Group PE than Group NE for the first 20 minutes with the difference being statistically significant at the 8 minute mark. The IASBP values were significantly lower in Group NE as compared to Group PE from 38 minute to 44 minutes after spinal anaesthesia and start of study.

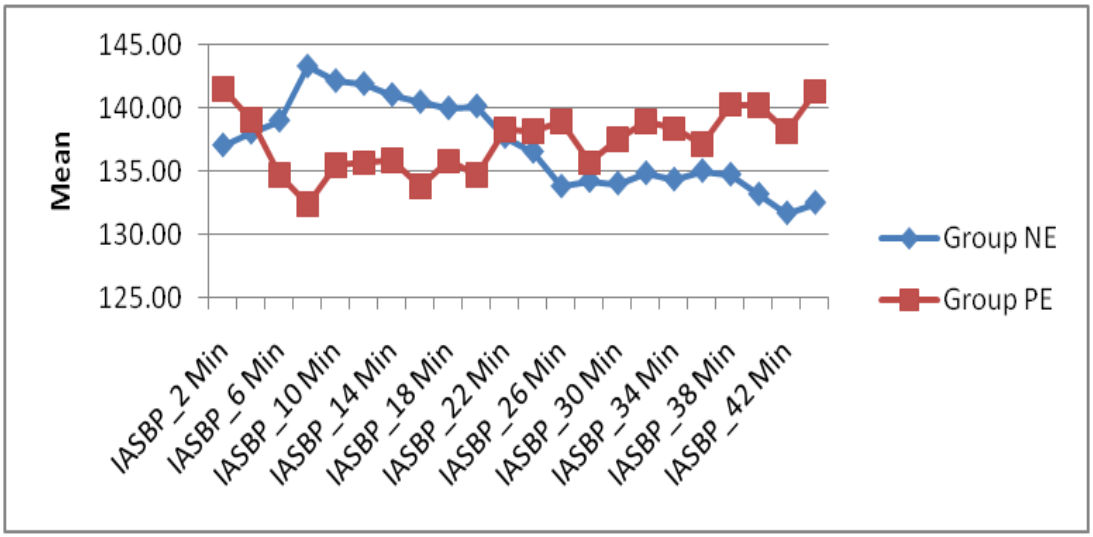

Figure 8: Trends in Intra Arterial Systolic Blood Pressure (IASBP)

6. Baseline Mean Intra Arterial Diastolic Blood Pressure (IADBP)

Table 6: Baseline intra arterial Diastolic Blood Pressure (IADBP)

DBP (mmHg)	Group NE		Group PE		Z	p-value
	Mean	SD	Mean	SD		
DBP_1 Min	78.79	11.44	79.76	11.53	-0.125	0.901
DBP_2 Min	77.66	10.95	79.57	12.04	-0.550	0.582
DBP_3 Min	78.73	11.73	79.24	11.41	-0.216	0.829
Mean DBP	78.07	11.28	79.25	11.44	-0.038	0.970

Mean values of IADBP was calculated in both the groups by taking three consecutive baseline values. The baseline and mean IASBP was 78 mmHg (+/-11) for Group NE and 79 mmHg (+/-11) for Group PE. Both the groups showed similar values with no significant difference.

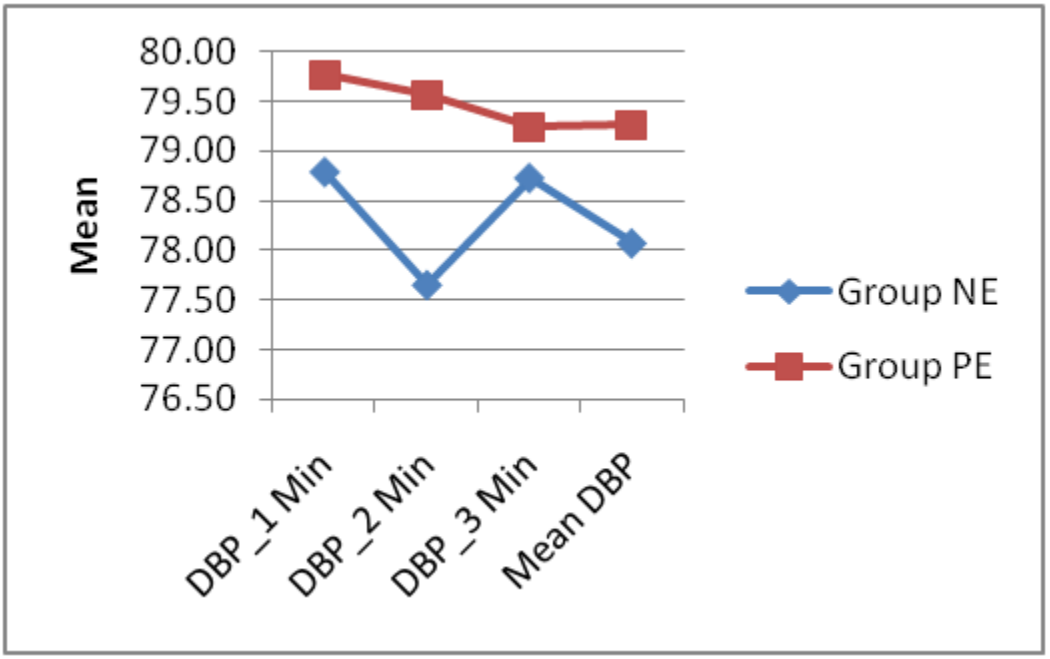

Figure 9: Mean Diastolic Blood Pressure

7. Trends in Intra Arterial Diastolic Blood Pressure (IADBP)

Table 7: Intra Arterial Diastolic Blood Pressure trends

IADBP (mmHg)	Group NE		Group PE		Z	p-value
	Mean	SD	Mean	SD		
IADBP_2 Min	75.03	10.91	76.93	10.60	-1.020	0.310
IADBP_4 Min	74.06	11.73	74.48	11.98	-0.307	0.759
IADBP_6 Min	75.87	14.18	73.22	14.55	-1.102	0.270
IADBP_8 Min	77.49	15.32	71.30	13.20	-2.364	0.018
IADBP_10 Min	78.58	15.13	72.10	13.00	-2.592	0.010
IADBP_12 Min	77.48	14.02	72.25	13.05	-2.153	0.031
IADBP_14 Min	77.84	13.24	72.88	11.96	-2.495	0.013
IADBP_16 Min	76.33	15.17	72.06	10.59	-2.641	0.008
IADBP_18 Min	78.61	11.47	71.63	10.98	-3.513	0.000
IADBP_20 Min	79.03	12.61	71.87	11.10	-3.298	0.001
IADBP_22 Min	78.22	11.36	72.84	10.22	-2.807	0.005
IADBP_24 Min	76.81	10.76	73.22	9.90	-2.304	0.021
IADBP_26 Min	77.61	11.40	73.54	10.20	-2.096	0.036
IADBP_28 Min	77.18	11.42	72.99	10.27	-2.237	0.025
IADBP_30 Min	76.57	11.28	72.84	10.12	-1.873	0.061
IADBP_32 Min	78.12	11.29	74.10	9.88	-2.225	0.026
IADBP_34 Min	78.34	11.02	74.12	10.30	-2.293	0.023
IADBP_36 Min	77.39	10.67	74.51	10.35	-1.942	0.052
IADBP_38 Min	77.46	10.72	75.19	10.05	-1.764	0.078
IADBP_40 Min	77.42	11.42	75.78	9.93	-0.824	0.410
IADBP_42 Min	75.48	11.03	75.70	9.76	-0.176	0.860
IADBP_44 Min	77.00	10.99	76.46	9.45	-0.397	0.691

With regards to trends of intra arterial diastolic blood pressure (IADBP) , significant differences were observed between the two groups at from 8 minutes to 28 minutes and then at 32 and 34 minutes after spinal anaesthesia. At all these time intervals the IADBP calculations showed significantly lower values in Group PE.

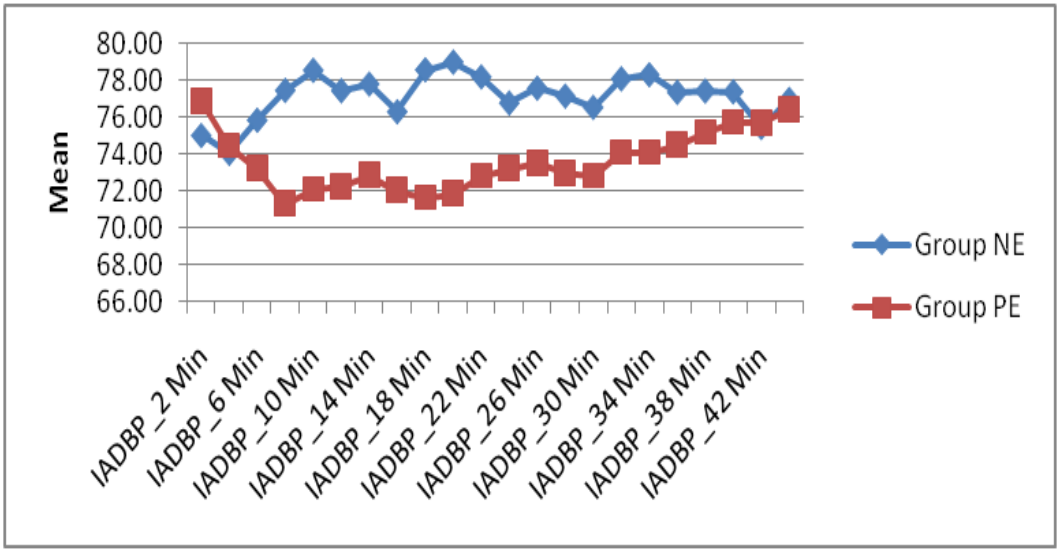

Figure 10: Trends in Intra Arterial Diastolic Blood Pressure (IADBP)

8. Baseline Mean of Mean Arterial Pressure (MAP)

Table 8: Baseline Mean Arterial Pressure (MAP)

MAP (mmHg)	Group NE		Group PE		Z	p-value
	Mean	SD	Mean	SD		
MAP_1 Min	98.00	10.95	99.22	10.53	-0.657	0.512
MAP_2 Min	97.03	10.75	98.93	10.90	-1.016	0.311
MAP_3 Min	97.68	10.83	99.05	10.71	-0.735	0.464
Mean MAP	97.29	10.72	98.78	10.52	-0.808	0.420

The mean value of MAP was calculated in both groups by taking three consecutive baseline values. The baseline mean MAP values for Group NE was 97 mmHg (+/-10) and for Group PE was 98 mmHg (+/-10). The baseline and mean MAP showed equivalent values in the two study groups and the difference was insignificant.

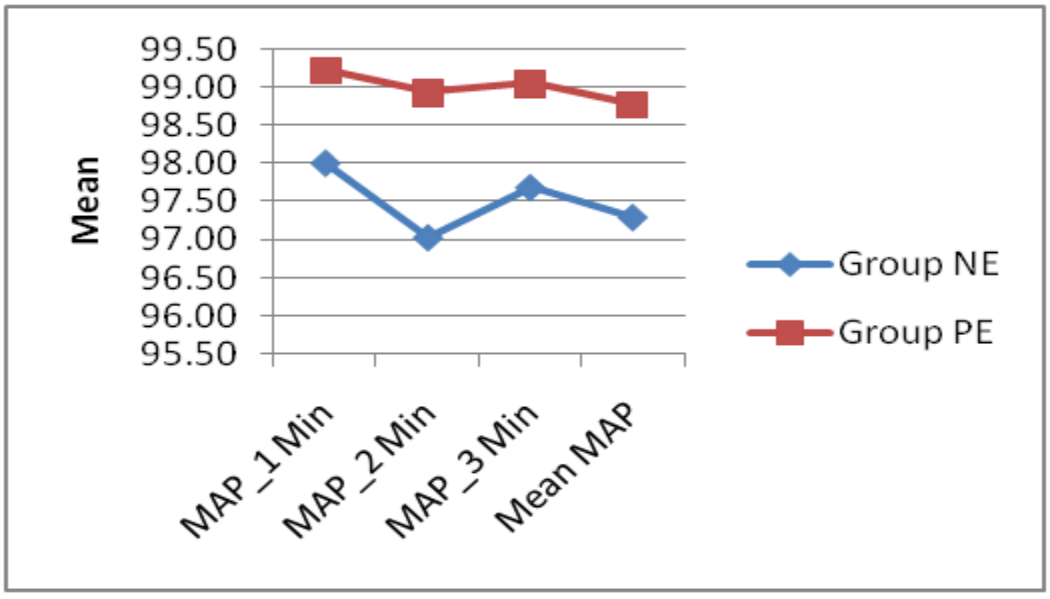

Figure 11: Mean Arterial Pressure

9. Trends in Mean Arterial Pressure (MAP)

Table 9: Mean Arterial Pressure trends

MAP (mmHg)	Group NE		Group PE		Z	p-value
	Mean	SD	Mean	SD		
MAP_2 Min	97.27	12.41	99.16	10.88	-0.940	0.349
MAP_4 Min	95.66	13.61	96.52	10.94	-0.785	0.433
MAP_6 Min	97.01	15.23	93.06	11.09	-1.795	0.073
MAP_8 Min	97.37	16.80	92.55	11.43	-1.682	0.093
MAP_10 Min	99.76	15.50	93.73	11.25	-2.804	0.005
MAP_12 Min	98.70	15.10	94.06	10.88	-2.152	0.031
MAP_14 Min	98.85	14.00	92.96	15.70	-2.568	0.010
MAP_16 Min	98.70	13.09	94.61	9.68	-2.606	0.009
MAP_18 Min	99.04	11.70	93.78	10.35	-2.863	0.004
MAP_20 Min	99.66	11.31	94.18	10.59	-3.002	0.003
MAP_22 Min	96.70	14.74	95.21	9.31	-1.598	0.110
MAP_24 Min	97.15	10.01	95.46	9.22	-1.042	0.297
MAP_26 Min	96.93	10.19	96.12	9.19	-0.834	0.405
MAP_28 Min	96.31	10.36	94.76	9.54	-1.228	0.220
MAP_30 Min	95.72	10.66	95.18	9.03	-0.138	0.890
MAP_32 Min	96.81	10.27	96.18	8.94	-0.499	0.618
MAP_34 Min	97.12	10.12	95.88	9.42	-1.087	0.277
MAP_36 Min	96.49	9.92	96.04	9.68	-0.648	0.517
MAP_38 Min	97.15	10.05	97.22	9.25	-0.437	0.662
MAP_40 Min	95.94	10.15	97.49	9.35	-0.544	0.587
MAP_42 Min	94.36	10.32	97.34	9.09	-1.439	0.150
MAP_44 Min	95.57	9.85	97.88	9.32	-1.232	0.218

Statistically significant differences were observed in the two groups in relation to the trends of mean arterial pressure with lower values for Group PE from 10 minutes to 20 minutes in comparison with Group NE .

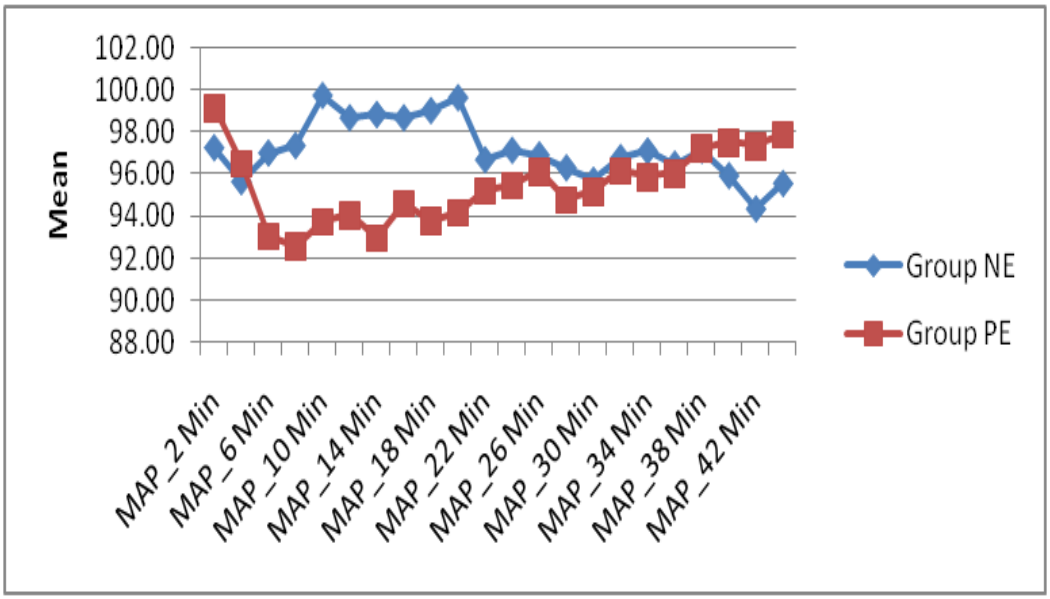

Figure12: Trends in Mean Arterial Pressure

10. Number of patients who experienced varying episodes of hypotension

Table 10: Episodes of hypotension

		Group NE		Group PE		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
Episodes of hypotension	0	50	74.6%	47	70.1%	97	4.529	0.104
	1	14	20.9%	10	14.9%	24		
	2	3	4.5%	10	14.9%	13		
Total		67	100.0%	67	100.0%	134		

In Group NE, 17 (25.4%) patients developed hypotension in comparison to 20 (29.8%) patients in Group PE. The number of patients developing episodes of hypotension were more in Group PE, however, the difference was not significant when compared in the two study groups. Thus both study solutions exhibited comparable efficacy in prevention of hypotension after administration of spinal anaesthesia. Out of the total 134 patients, 50 (74.6%) patients in Group NE and 47 (70.1%) patients in Group PE showed no episodes of hypotension during the duration of study.

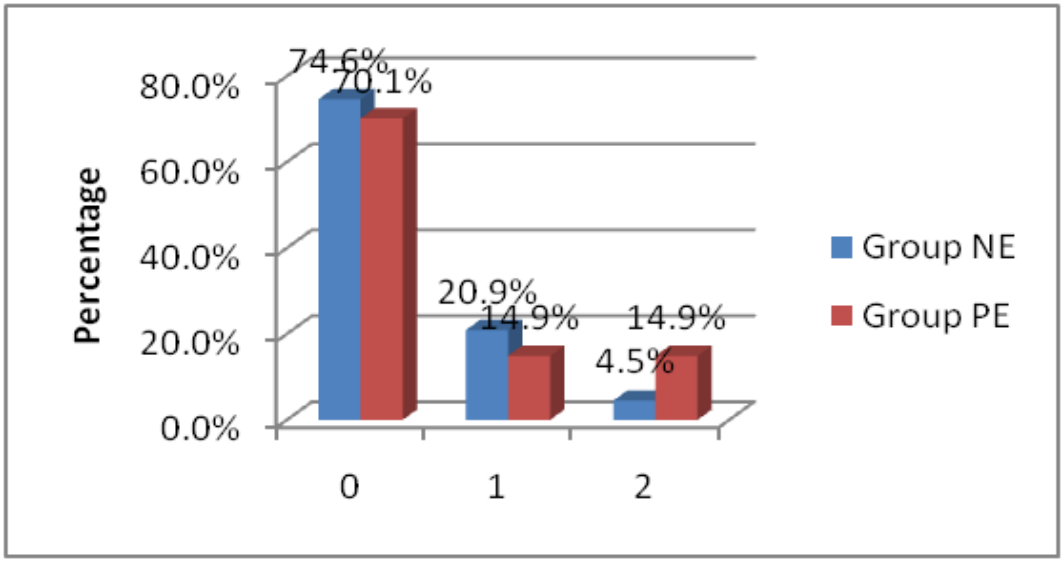

Figure 13: Episodes of Hypotension

11. Number of patients who required rescue bolus for episodes of hypotension

Table 11: Rescue Bolus required

		Group NE		Group PE		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
Rescue Bolus required	NO	53	79.1%	47	70.1%	100	1.419	0.234
	YES	14	20.9%	20	29.9%	34		
Total		67	100.0%	67	100.0%	134		

A total of 34 patients required rescue bolus for hypotensive episodes of which 14 patients (20.9%) belonged to Group NE and 20 patients (29.9%) were allocated Group PE. The difference of number of patients who were given a rescue bolus was not significant.

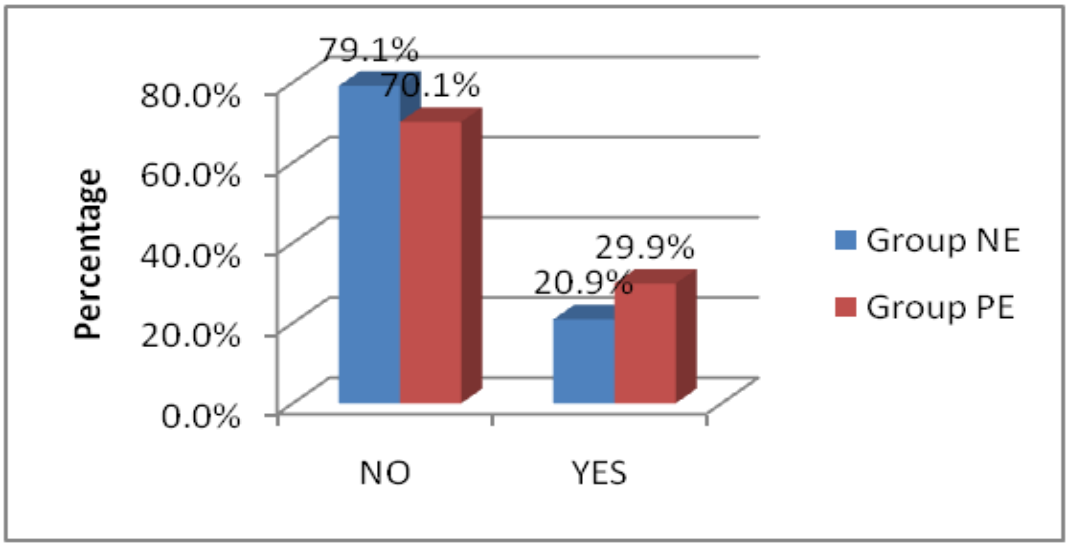

Figure 14: Rescue Bolus

12. First rescue bolus given

Table 12: First rescue bolus given

		Group NE		Group PE		Total	Chi-square value	p-value
	TIME (minutes)	No. of cases	%age	No. of cases	%age			
First Rescue Bolus given	4	3	4.5%	2	3.0%	5	24.091	0.001
	6	3	4.5%	0	0.0%	3		
	8	0	0.0%	8	11.9%	8		
	10	3	4.5%	0	0.0%	3		
	14	2	3.0%	3	4.5%	5		
	16	2	3.0%	0	0.0%	2		
	18	0	0.0%	7	10.4%	7		
	26	1	1.5%	0	0.0%	1		
Total		14	20.9%	20	29.9%	34		

From 37 patients , first rescue bolus was required in five patients at 4 minutes out of which 3 were from Group NE and 2 from Group PE , 3 patients at 6 minutes , all these patients were from Group NE, 8 patients at 8 minutes , all these patients were from Group PE , 3 patients at 10 minutes, all these patients were from Group NE , 5 patients at 14 minutes out of which 2 belonged to Group NE and 3 to Group PE , 2 patients at 16 minutes , all belonging to Group NE , 7 patients at 18 minutes , all of which were from Group PE and 1 patient at 26 minutes who was allocated Group NE.

The difference between the study groups in the first rescue bolus received was significant at all time intervals.

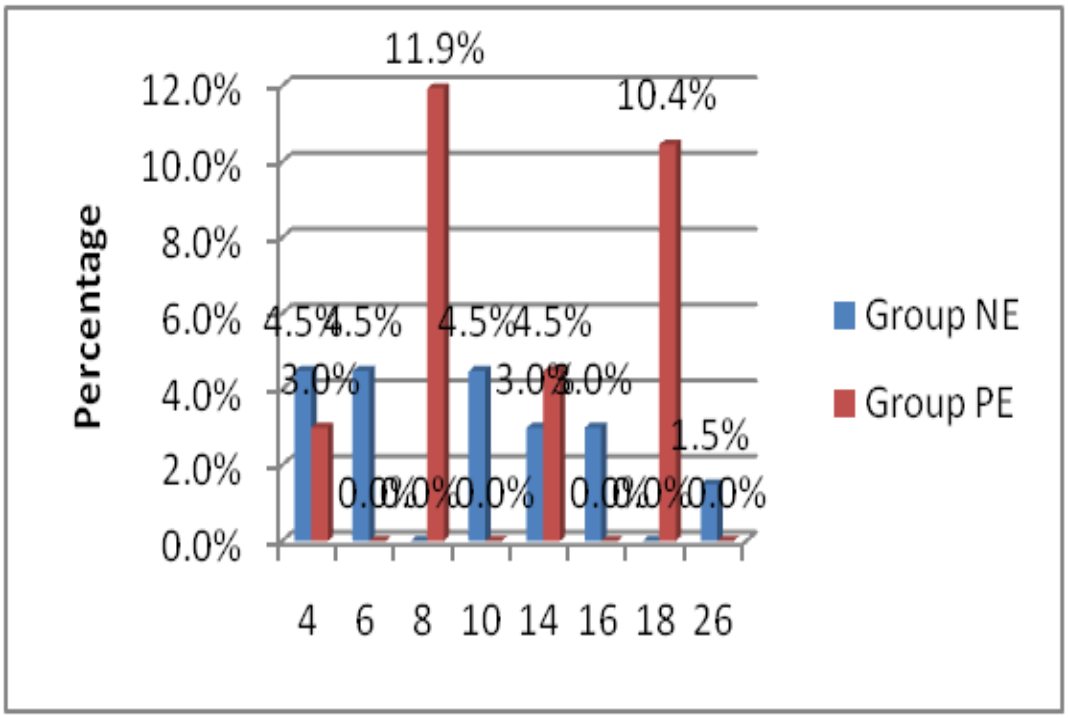

Figure 15: First Rescue Bolus

13. Number of patients who required intervention for episodes of hypotension

Table 13: Number of patients who required intervention for episodes of hypotension

		Group NE		Group PE		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
Intervention for hypotension	NO	50	74.6%	47	70.1%	97	4.152	0.125
	Bolus + infusion increased by 20%	14	20.9%	20	29.9%	34		
	infusion restarted at 50%	3	4.5%	0	0.0%	3		
Total		67	100.0%	67	100.0%	134		

Out of the 134 patients recruited for the study, 37 patients required intervention for hypotension. The first type of intervention was administration of a rescue bolus followed by increasing the infusion rate of the study solution by 20 %, which was required in 34 patients developing hypotension. Of these 34 patients, 14 (20.9%) patients were from Group NE and 20 (29.9%) patients were from Group PE. The second type of intervention was re-starting a stopped infusion of study solution at 50% of the original rate. This was done in patients who developed hypotension after periods of hypertension. There were three such patients (4.5%) in the NE group with none from Group PE.

The difference in the number of patients requiring these two types of intervention was comparable between the two groups.

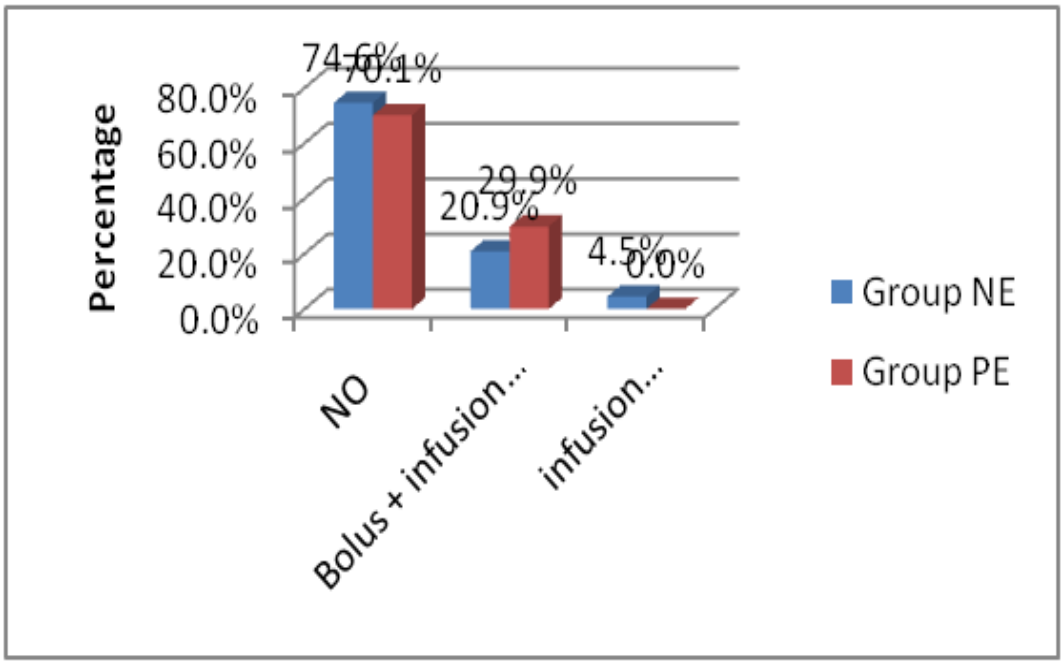

Figure 16: Intervention for Hypotension

14. Number of patients who experienced episodes of hypertension

Table 14: Episodes of hypertension

		Group NE		Group PE		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
Episodes of hypertension	0	39	58.2%	67	100.0%	106	35.396	0.001
	1	19	28.4%	0	0.0%	19		
	3	9	13.4%	0	0.0%	9		
Total		67	100.0%	67	100.0%	134		

A total of 28 patients (20.8%) who experienced hypertension episodes belonged to Group NE. Out of these 28 patients, 19 patients (28.4%) experienced a single episode of hypertension and 9 patients (13.4%) had 3 episodes of hypertension. There were no patients from Group PE who experienced hypertension. Thus, the difference in the number of patients who experienced episodes of hypertension was significant.

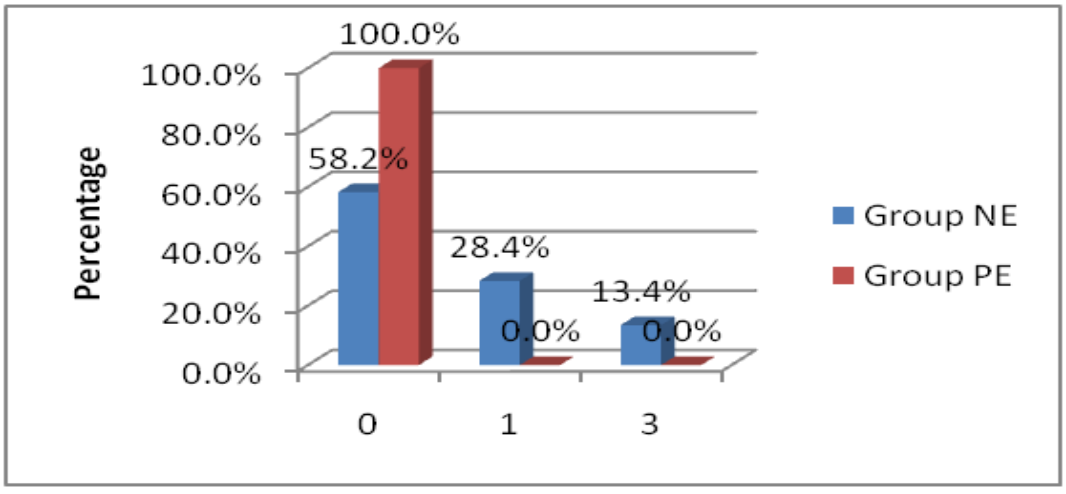

Figure 17: Episodes of Hypertension

15. Number of patients who required intervention for hypertension.

Table 15: Number of patients who required intervention for hypertension

		Group NE		Group PE		Total	Chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
Intervention for hypertension	No	39	58.2%	67	100.0%	106	35.396	0.001
	infusion rate reduced by 50%	19	28.4%	0	0.0%	19		
	infusion rate reduced by 50% and infusion stopped	9	13.4%	0	0.0%	9		
Total		67	100.0%	67	100.0%	134		

From 134 total patients, the number of patients who required intervention for episodes of hypertension was 28 (20.8%). All the patients were from Group NE. The first type of intervention was reduction of infusion rate by 50% which was performed in 19 (28.4%) Group NE patients. The second type of intervention included stopping the infusion of study solution completely after initial reduction of infusion rate of study solution by 50%. There were no patients in Group PE who required any intervention for hypertension episodes. There was significant difference in the two study groups in the number of patients who required intervention for episodes of hypertension.

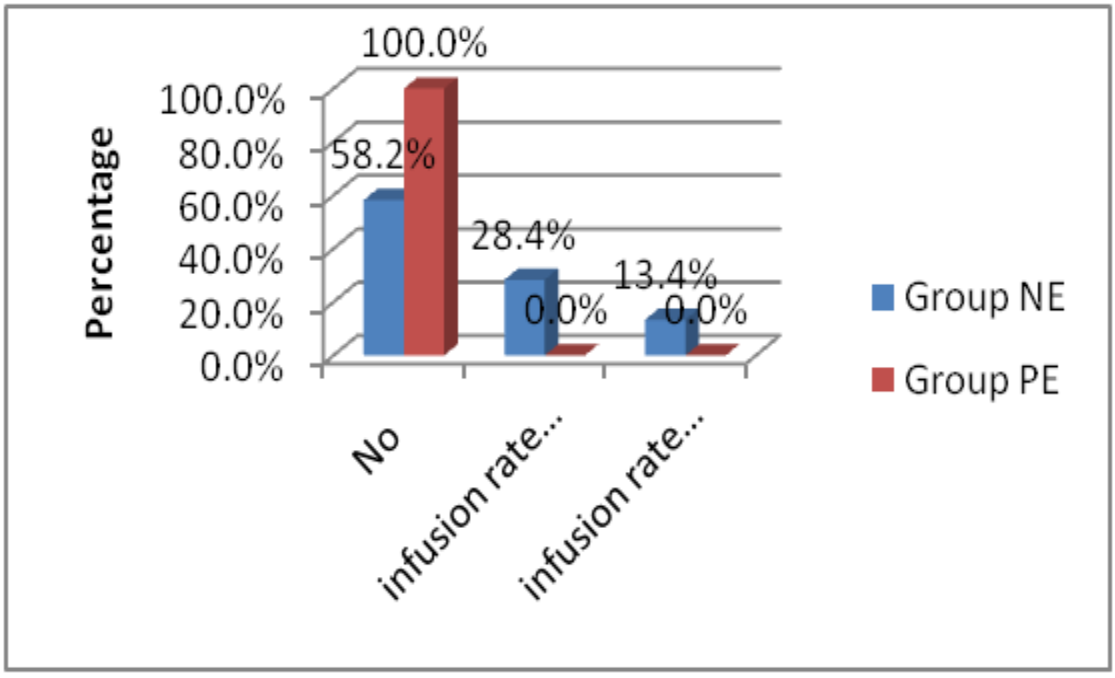

Figure 18: Intervention for Hypertension

16. Baseline oxygen saturation (SpO_2)

Table 16: Baseline oxygen saturation (SpO_2)

Oxygen saturation	Group NE		Group PE		Z	p-value
	Mean	SD	Mean	SD		
SpO_2_1 Min	98.93	1.45	98.73	1.57	-0.751	0.453
SpO_2_2 Min	98.64	1.51	98.66	1.63	-0.240	0.810
SpO_2_3 Min	98.79	1.38	98.78	1.51	-0.120	0.904
Mean SpO2	99.01	1.44	98.76	1.50	-1.309	0.191

The mean baseline value SpO_2 for was calculated in both groups by taking three consecutive baseline values. The baseline mean oxygen saturation was 99 (+/- 1.44) for Group NE and 98 (+/- 1.5) for Group PE. The baseline and mean values of oxygen saturation were statistically insignificant in both the study groups.

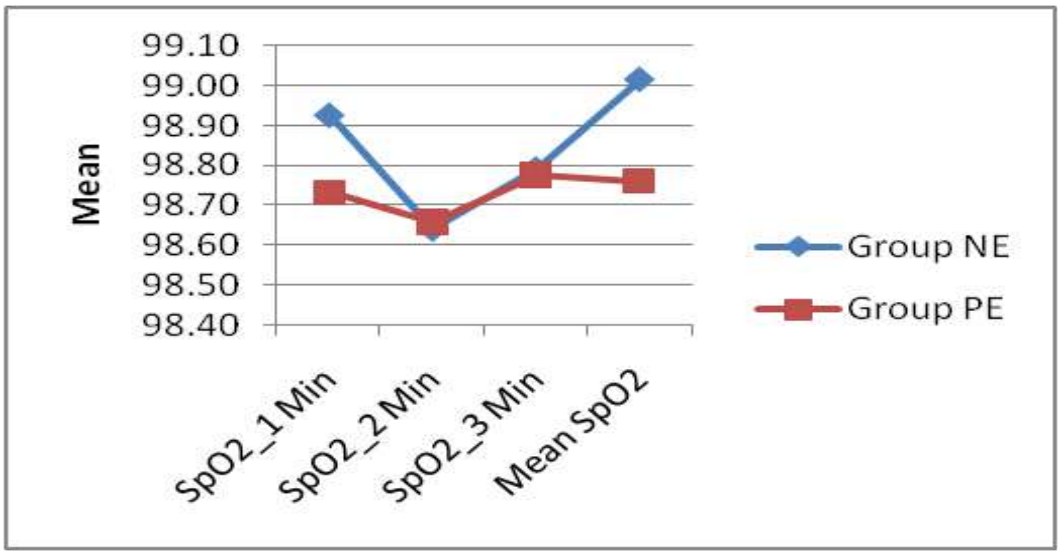

Figure 19: Baseline oxygen saturation (SpO2)

17. Trends in oxygen saturation (SpO_2)

Table 17: Oxygen saturation trends

	Group NE		Group PE		Z	p-value
	Mean	SD	Mean	SD		
$Sp0_2$_2 Min	98.81	1.40	98.55	1.64	-0.669	0.503
$Sp0_2$_4 Min	98.87	1.43	98.58	1.30	-1.517	0.129
$Sp0_2$_6 Min	98.69	1.28	98.24	1.61	-1.536	0.124
$Sp0_2$_8 Min	98.70	1.34	98.15	1.68	-1.948	0.051
$Sp0_2$_10 Min	98.61	1.40	98.49	1.42	-0.671	0.502
$Sp0_2$_12 Min	98.63	1.48	98.24	1.50	-1.498	0.134
$Sp0_2$_14 Min	98.67	1.44	98.19	1.62	-1.751	0.080
$Sp0_2$_16 Min	98.39	1.47	98.34	1.64	-0.043	0.965
$Sp0_2$_18 Min	98.51	1.28	98.28	1.56	-0.716	0.474
$Sp0_2$_20 Min	98.70	1.18	98.63	1.25	-0.312	0.755
$Sp0_2$_22 Min	98.81	1.20	98.67	1.16	-0.703	0.482
$Sp0_2$_24 Min	98.67	1.33	98.34	1.47	-1.234	0.217
$Sp0_2$_26 Min	98.76	1.26	98.55	1.37	-0.853	0.394
$Sp0_2$_28 Min	98.64	1.31	98.31	1.61	-1.023	0.306
$Sp0_2$_30 Min	98.78	1.39	98.52	1.46	-1.090	0.276
$Sp0_2$_32 Min	98.69	1.35	98.19	1.63	-1.809	0.071
$Sp0_2$_34 Min	98.85	1.27	98.51	1.58	-1.193	0.233
Sp02_36 Min	98.84	1.27	98.43	1.60	-1.463	0.143
$Sp0_2$_38 Min	98.81	1.29	98.66	1.71	-0.014	0.989
Sp02_40 Min	98.97	1.28	98.70	1.47	-1.143	0.253
$Sp0_2$_42 Min	98.97	1.14	98.72	1.15	-1.487	0.137
$Sp0_2$_44 Min	98.94	1.25	98.78	1.18	-1.004	0.315

The oxygen saturation shows that there is stastitcally insignificant difference in the levels of SpO2 in either of the two groups of study solution.

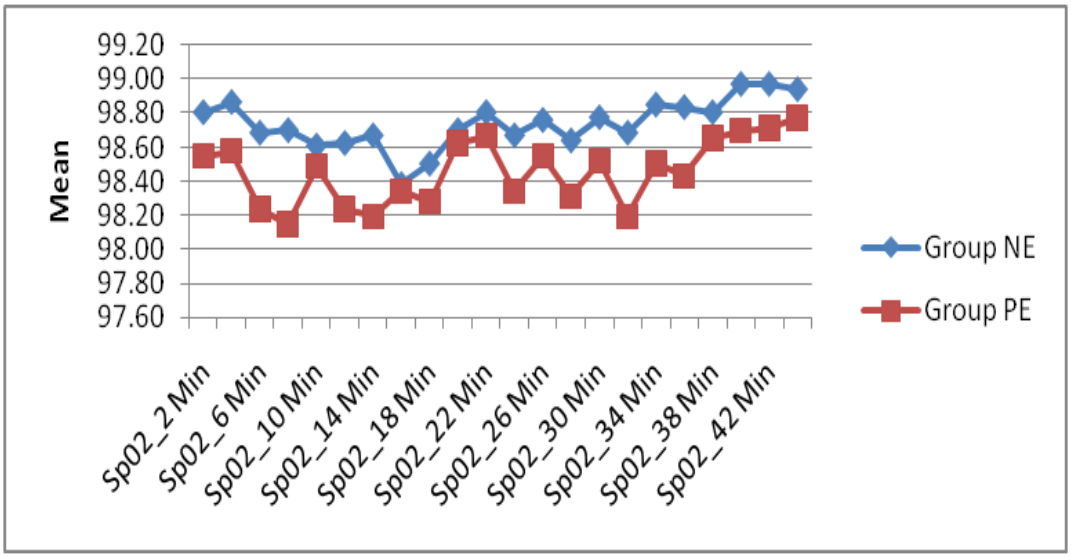

Figure 20: Trends in oxygen saturation (SpO_2)

18. Infusion Rate of study solution

Table 18: Infusion Rate of study solution

	Group NE		Group PE		Z	p-value
	Mean	SD	Mean	SD		
Infusion Rate_2 Min	61.12	6.44	60.00	0.00	-1.420	0.156
Infusion Rate_4 Min	60.49	2.31	60.36	2.06	-0.440	0.660
Infusion Rate_6 Min	59.27	8.25	60.36	2.06	-0.045	0.964
Infusion Rate_8 Min	61.16	3.58	60.82	7.84	-0.413	0.680
Infusion Rate_10 Min	57.39	12.13	61.79	4.31	-1.738	0.082
Infusion Rate_12 Min	55.38	13.96	61.79	4.31	-2.355	0.019
Infusion Rate_14 Min	54.70	15.07	62.33	4.78	-2.537	0.011
Infusion Rate_16 Min	55.97	14.88	62.33	4.78	-1.777	0.076
Infusion Rate_18 Min	55.97	14.88	63.58	5.53	-2.611	0.009
Infusion Rate_20 Min	55.34	14.95	63.58	5.53	-2.938	0.003
Infusion Rate_22 Min	55.34	14.95	63.58	5.53	-2.938	0.003
Infusion Rate_24 Min	54.10	15.02	63.58	5.53	-3.592	0.001
Infusion Rate_26 Min	54.31	15.18	62.61	8.78	-3.074	0.002
Infusion Rate_28 Min	54.31	15.18	63.58	5.53	-3.379	0.001
Infusion Rate_30 Min	53.69	15.18	63.58	5.53	-3.704	0.001
Infusion Rate_32 Min	52.52	15.67	63.58	5.53	-4.080	0.001
Infusion Rate_34 Min	52.52	15.67	63.58	5.53	-4.080	0.001
Infusion Rate_36 Min	52.52	15.67	63.58	5.53	-4.080	0.001
Infusion Rate_38 Min	52.52	15.67	63.58	5.53	-4.080	0.001
Infusion Rate_40 Min	52.52	15.67	63.58	5.53	-4.080	0.001
Infusion Rate_42 Min	52.52	15.67	63.64	5.56	-4.091	0.001
Infusion Rate_44 Min	52.52	15.67	63.64	5.56	-4.091	0.001

Infusion rate of the study solution was observed and it was found that the rate of infusion of the study solution was comparable for both study groups for the first 10 minutes. However , after 10 minutes the infusion rate was lower for Group NE in comparison to Group PE and the difference was found to be stastically significant at 12 and 14 minute and then from 16 minutes to 44 minutes

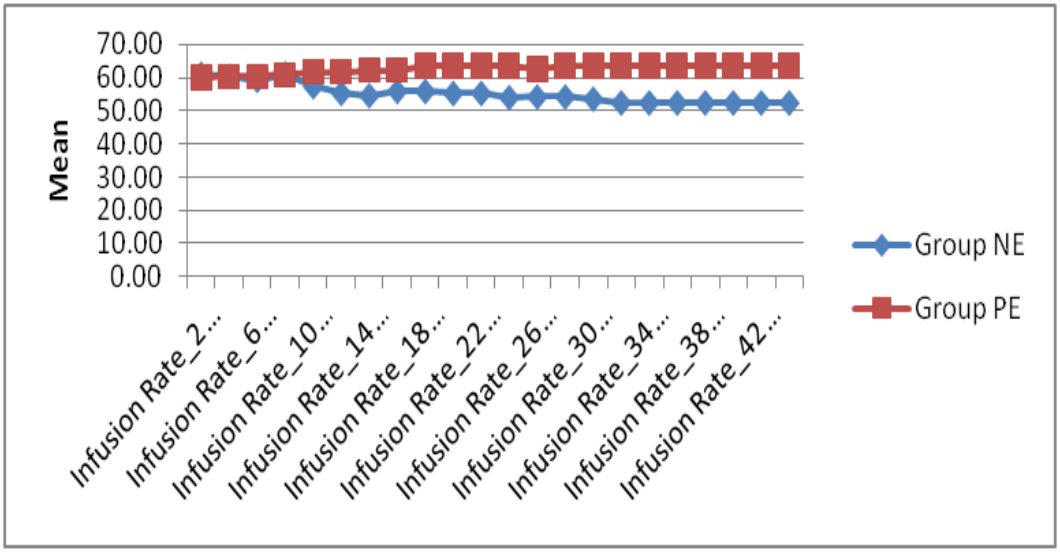

Figure 21: Trends of Infusion Rate of study solution

19. Total amount of drug used (in mcg)

Table 19: Total amount of drug used (mcg)

	Group NE		Group PE		Z	p-value
	Mean	SD	Mean	SD		
Total amount of drug used (mcg)	38.30	14.27	51.21	9.93	-5.049	0.001

Total amount of drug used for Group NE was 38.3 mcg (+/-14.27) and for Group PE was 51.21 mcg (+/-9.93). Lesser amount of drug was used in Group NE as compared to Group PE and the difference was significant.

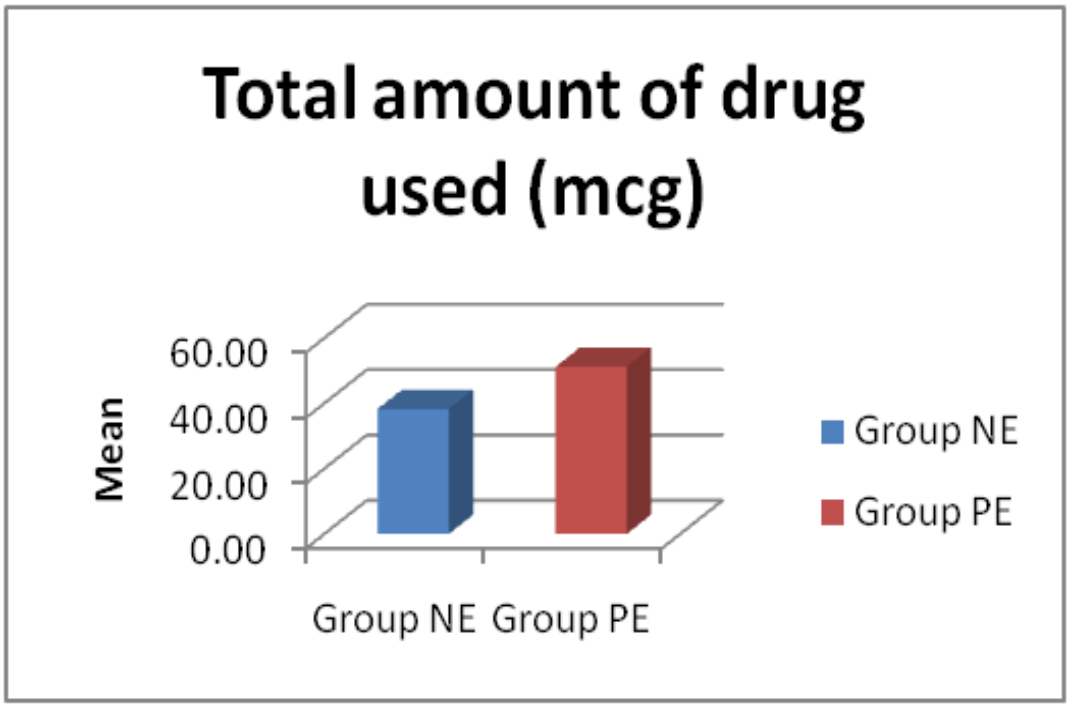

Figure 22: Total amount of drug used (mcg)

DISCUSSION

The elderly population is highly vulnerable to fractures of long bone. These are termed as geriatric fractures. The reason for this vulnerability stems from causes that are multifactorial, most common being osteoporosis and advancing age[1]. Hip fractures are the most frequent type of fracture and need surgical intervention[7]. Central Neuraxial blockade, in the form of spinal anaesthesia, is the ubiquitous technique used for providing anaesthesia for majority of these surgeries.

The most typical side effect of spinal anaesthesia is intraoperative hypotension. The spinal induced hypotension is particularly notorious in the elderly as it is associated with increased susceptibility to mortality and morbidity[4]. Therefore, it is important to contain the occurrence of hypotension after spinal anaesthesia to improve the outcome for the geriatric group of patients. Traditional methods for prevention of spinal induced hypotension include crystalloid loading. The various co-morbidities, especially those associated with the cardiovascular system, along with advancing age puts the elderly at risk[9] of landing into fluid overload. This can worsen the prognosis of the patients post surgey.
Vasopressors for prophylaxis of spinal induced hypotension is more effective in controlling intra operative blood pressure[16].

The most common vasopressors in use are Phenylephrine and Norepinephrine. Both these vasopressor agents result in the vasoconstriction of the arterial and venous circulation, leading to an increase in systemic vascular resistance and venous return and therefore, raise the blood pressure[33]. This helps to maintain intraoperative blood pressure and prevent hypotension in patients receiving spinal anaesthesia. There is a dearth of research with regard to comparison of infusions of Phenylephrine and Norepinephrine for maintenance of

hemodynamics in elderly patients for orthopaedic surgeries under sub arachnoid block.

Hence, we compared efficacy of prophylactic manually controlled infusions of Phenylephrine and Norepinephrine in maintaining the systolic blood pressure using invasive intra arterial blood pressure monitoring in patients above 60 years of age posted for hip and femur surgeries. The primary outcome was incidence of hypotension and the secondary outcome was the incidence of hypertension and bradycardia and the total amount of vasopressor used.

We derived our equipotent dosing protocol based on results of previous study by Ngan Kee estimated that the relative potency between Phenylephrine and Norepinephrine was 1:13[2,34]. Therefore, we hypothesized that a Norepinephrine dose of 8 micrograms would be equipotent to a Phenylephrine dose of 100 micrograms. Studies comparing these two drugs in patients undergoing cesarean sections have used potency ratio of 1:20[14,35,36], but many studies published lately have suggested lower potency ratio ranging from 1:16 to 1:13[2,34]. We adapted our infusion methodology from algorithm protocol used by Mostafa M et al for manually controlled infusions in order to formulate an easy to titrate infusions suited to clinical settings of our study. We targeted to maintain the systolic blood pressure at 100% of the baseline value by changing the infusion rate as per the study protocol.

The demographics including age , gender and ASA grading of the patients selected for our study were similar in the two study groups. Thus, comparable confounders did not have the ability to bias the findings of our study.

We observed statistically comparable efficacy of both Phenylephrine and Norepinephrine in reducing the occurrence of spinal induced hypotension. 74.6% of patients in Group NE had no episodes of hypotension. In parallel, 70.1% patients in Group PE showed no occurrence of hypotension. Although, overall, more number of patients developed hypotension in Group PE (20 patients as compared to 17 patients in Group NE) with the number of patients experiencing more than one episode of hypotension being even higher (10 patients with 2 episodes of hypotension as compared to 3 in Group NE), these differences were not statistically significant. Both Norepinephrine and Phenylephrine exert their vascular action through the activation of α-receptors[33]. The alpha-1 receptors are found on vascular smooth muscles and determine arteriolar resistance and venous capacitance, and thus maintain the blood pressure(37). These findings are in accordance with M Mostafa et al. who, in their study, compared the two drugs in a similar group of patients. None of the patients in either of the group developed any episode of hypotension during the course of the research. They concluded that both vasopressors successfully prevented hypotension in elderly patients posted for hip fracture repair surgeries[2].

In our study, intraoperative Intra Arterial Systolic Blood Pressure (IASBP) trends showed that for the first 20 minutes, the systolic blood pressure was lower for Group PE than Group NE with the difference being statistically significant at the 8 minute mark. However, later, IASBP values were lower for Group NE than Group PE with statistically significant differences observed from 38 minute to 44 minutes after spinal anaesthesia. Thus, Norepinephrine, which has dual action through both alpha and beta receptor stimulation(2,11,27,33,35), shows a more formidable effect on blood pressure during the early period of start of infusion. However, Phenylephrine, which is a sole alpha receptor stimulator(2,33,36), requires a longer time of infusion to exert a similar effect.

The trends for Intra Arterial Diastolic Blood Pressure (IADBP) and Mean Arterial Pressure (MAP) showed similar results. The values were higher for Group NE than Group PE for the entire duration of study. The values of IADBP show statistically significant difference from 8 to 34 minutes of study. MAP values are significantly higher for Group NE at 10 to 20 minutes of study.

The time of first rescue bolus shows that more number of patients in Group NE received rescue bolus for hypotensive episodes in the initial 10 minutes of the study (9 out of the 14). However, only five patients required rescue bolus after 10 minutes of start of study. In contrast, in Group PE, 10 patients out of the 20 who required rescue bolus received the first rescue bolus after the 10 minutes of start of study solution. This difference in time of first rescue bolus is statistically significant. Hence, with use of Norepinephrine infusion, the occurrence of episodes of hypotension were largely seen in the initial phase with later stages showing lesser need of rescue boluses as compared to Group PE where rescue boluses were given in later stages. No rescue bolus was required after the initial 26 minutes of study in either of the two groups.

We report that the infusion rate of the study solution was comparable for both study groups for the first 10 minutes but after 10 minutes, the infusion rate was lower for Group NE and the difference was statistically significant at 12 minute , 14 minute and then from 16 minutes to 44 minutes. This is because of the need to reduce the rate of infusion of Norepinephrine in response to episodes of intraoperative hypertension. Thus, we suggest that preparation of Norepinephrine infusion, based on a more correct potency calculation, would require a lower rate of infusion.

Another parameter which was found to be significant was the incidence of hypertension. A total of 28 patients had hypertension and all of them

patients were in Group NE with no patients in Group PE. Phenylephrine has pure alpha stimulation activity. In disparity, Norepinephrine, in addition to alpha receptor stimulation, also has a modest beta receptor agonist activity, leading to a more potent effect on blood pressure which can be the cause of increased number of patients with intraoperative hypertension episodes in the Group NE. These findings are identical to a study by A Mohamed et al, where they compared infusions of Norepinephrine and Vasopressin in patients undergoing surgery under sub arachnoid block using invasive arterial blood pressure monitoring technique. They reported a significantly higher incidence of increase in Systolic Blood Pressure by > 10% of baseline value with use of infusion Norepinephrine[28].

The findings of our study are in contradiction to a study by M Mostafa et al where reactive hypertension was higher in Phenylephrine group, compared to patients given Norepinephrine infusion[2]. This could be because of different patient profile. They included only ASA Grade I and II patients excluding those with known cardiac abnormalities in contrast to our study, where we included patients with ASA grade I to IV. Similar findings have been found in previous studies that compared the two drugs in cesarean delivery(14,17,29,30,35). But gravid females undergo compensatory cardiovascular changes owing to the physiological changes of pregnancy which can alter their response to autonomic activation by vasopressors. Also, M Mostafa et al and other studies in cesarean sections have used non invasive techniques of blood pressure monitoring, whereas, we used invasive intra arterial blood pressure monitoring.(2,14,17,29,30,35)

On comparing the two study groups, we saw that a significantly lesser amount of drug of the study solution was used in patients allocated in Group NE as compared to Group PE. This is in continuation of our other findings of lower infusion rate, lesser need for rescue boluses, and higher

incidences of hypertension in patients receiving Norepinephrine infusion during the study.
We, therefore, speculate that the use of Norepinephrine, when correctly adjusted for potency, would yield a better result in prophylaxis of spinal induced hypotension at lower vasopressor infusion rates and thus a lesser amount of drug.

The number of patients who required a rescue bolus for episodes of hypotension was not significant. Of the 34 patients who required rescue bolus, more patients belonged to Group PE [20] as compared to Group NE [14]. Similar to our study, MC Vallejo et al, compared the two drugs and found no difference between the study groups in terms of the rescue vasopressor boluses[17].

The trends of heart rate and oxygen saturation were comparable for both the study groups. There were no episodes of bradycardia during our study. This is in contrast to study by M Mostafa et al where they found incidences of reactive bradycardia with use of Phenylephrine infusion[2]. Similar to our study, a study by A Rahman, compared Phenylephrine with Ephedrine for hip surgeries and showed no episodes of bradycardia in either group[21].

Our study has some concerns and limitations. We used the available evidence for choosing the equipotent dose of NE to PE, depending on the data obtained from the obstetric population. Future dose-response studies are needed to identify equipotent doses of the two drugs and optimum dosing in the elderly population. Also, we did not consider any comorbidity as an exclusion criteria. Future research could evaluate the efficacy of both drugs in patients with specific comorbidities, especially patients with issues of the cardiovascular system.

To conclude, use of prophylactic vasopressor infusions of both the Norepinephrine and Phenylephrine are effective in prevention of spinal induced hypotension in elderly patients undergoing hip and femur surgeries. However, in our study, the use of Phenylephrine infusion was more successful in maintaining hemodynamic stability with no episodes of reactive hypertension and bradycardia as compared with the infusion of Norepinephrine where episodes of hypertension were seen.

SUMMARY AND CONCLUSION

This randomised double blind interventionall study was conducted in the department of Anaesthesiology, Dayanand Medical College and Hospital Ludhiana after approval by Institutional Ethics Committee on a total of 134 elderly patients undergoing hip and femur surgeries under sub arachnoid block. The patients were randomly allocated into either of the two study groups of 67 each by computer generated randomisation codes contained in sealed, sequentially numbered envelopes. A written informed consent was obtained from each patient.

A total of 134 elderly patients were randomised into either of the two groups:

- **Group NE:** comprising of 67 patients who received Norepinephrine 8 micrograms/ml in a manually controlled infusion titrated to our protocol at the rate constrained between 0-60 ml/hour, targeting maintenance of SBP at 100% of its baseline value.
- **Group PE:** comprising of 67 patients who received Phenylephrine 100 micrograms/ml in a manually controlled infusion titrated to our protocol at the rate constrained between 0-60 ml/hour, targeting maintenance of SBP at 100% of its baseline value.

A solution of either Norepinephrine 8 micrograms/ml or Phenylephrine 100 micrograms/ml was started before intrathecal injection and IABP monitoring was done at 2 minute intervals, upto to 45 minutes after spinal anaesthesia . The primary outcome measured was incidence of hypotension which were recorded whenever intra arterial systolic blood pressure fell below 80% of baseline values. The secondary outcomes measured were episodes of hypertension, incidence of bradycardia and total amount of drug infused upto 45 minutes after spinal anaesthesia.
The following conclusions were drawn :

1. The demographic profile in terms of age, gender and ASA grade of patients enrolled in the study was comparable among both the study groups.
2. The incidence of intraoperative hypotension were comparable in both the groups (17 patients in Group NE and 20 patients in Group PE). Thus both infusions exhibited comparable efficacy in preventing hypotension (74.6% versus 70.1% in Group NE and PE respectively with no episodes of hypotension)
3. The number of patients who required rescue bolus for hypotensive episodes were comparable in both the groups, with 14 patients receiving a rescue bolus in Group NE and 20 patients in Group PE. The p-value was 0.234.
4. The time of recieving first rescue bolus showed statistically significant difference in the two groups. More number of patients in Group NE received rescue bolus for hypotensive episodes in the initial 10 minutes of the study (9 out of the 14) and only 5 patients required rescue bolus after 10 minutes of start of study. However, in Group PE, 10 patients out of the 20 who required rescue bolus received the first rescue bolus after the initial 10 minutes.
5. There were 28 patients developing intraoperative hypertension. All of them were from Group NE. None of the patients in Group PE had episodes of hypertension. Thus, the difference in number of patients with intraoperative hypertensive episodes was statistically significant.
6. The number of patients who received intervention in the form of reducing infusion rate by 50% for single episode of hypertension (19 out of 28) and stopping the infusion after initially reducing it by 50% for multiple episodes of hypertension (9 out of 28) were all from Group NE. The difference was statistically significant.
7. The infusion rate of the study solution was comparable for both study groups for the first 10 minutes but after 10 minutes, the

infusion rate was lower for Group NE with statistically significant values at 12 minute , 14 minute and then from 18 minutes till end of study.

8. The total amount of drug used was significantly less for Group NE [38.3 mcg (+/-14.27)] as compared to Group PE [51.21 mcg (+/-9.93)] with p-value of 0.001.
9. The trends of intraoperative heart rate were comparable in the two groups with no episodes of bradycardia observed during the study.
10. Intraoperative median SpO2 values were comparable for both the study groups and no patient in either of the groups had oxygen saturation level less than 98%.

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Sr.No.	MRD No.	AGE	SEX	ASA Grade	GROUP	Study solution	HR_1 Min	HR_2 Min	HR_3 Min	Mean HR	SBP_1 Min	SBP_2 Min	SBP_3 Min	Mean SBP	80% of SBP	120% of SBP	DBP_1 Min	DBP_2 Min	DBP_3 Min	Mean DBP	MAP_1 Min	MAP_2 Min	MAP_3 Min	Mean MAP	SpO2_1 Min	SpO2_2 Min	SpO2_3 Min	Mean SpO2	HR_2 Min	HR_4 Min	HR_6 Min	HR_8 Min	HR_10 Min
1	1428497	85	FEMALE	3	NE	norepinephrine	82	88	85	85	170	174	168	170	136	204	98	100	96	98	122	124	120	122	98	98	98	98	86	88	89	91	89
2	1461707	86	MALE	3	NE	norepinephrine	60	58	60	59	142	138	140	140	116	168	82	84	84	82	102	102	101	102	100	100	100	100	60	62	62	61	63
3	1463394	78	FEMALE	3	NE	norepinephrine	82	84	82	82	124	122	124	123	98	147	82	80	84	82	96	94	97	95	100	100	100	100	74	75	78	80	80
4	1465170	76	FEMALE	2	NE	norepinephrine	84	78	81	81	122	118	121	120	96	144	84	78	81	81	96	91	94	94	100	99	100	100	84	84	82	82	81
5	1457161	88	MALE	3	NE	norepinephrine	68	66	68	68	128	124	126	126	100	151	76	72	74	74	93	89	91	91	98	97	97	97	68	66	66	67	67
6	1470377	85	FEMALE	4	NE	norepinephrine	78	76	78	78	118	114	117	116	92	139	68	64	63	65	84	80	81	81	97	96	96	96	70	71	71	73	74
7	1472498	79	MALE	3	NE	norepinephrine	72	70	72	72	131	132	132	132	105	158	78	74	76	74	92	93	95	93	100	100	98	100	68	69	72	72	70
8	1489933	78	FEMALE	3	NE	norepinephrine	82	80	80	80	133	131	132	132	105	158	72	73	74	73	92	92	92	92	100	96	100	100	80	81	80	83	84
9	1491633	84	FEMALE	3	NE	norepinephrine	97	92	94	94	108	112	104	108	86	129	64	60	68	64	78	77	80	78	98	99	99	99	92	90	86	80	84
10	1450177	61	FEMALE	3	PE	phenylephrine	84	92	88	88	152	151	150	151	120	181	88	87	82	85	109	108	105	107	98	99	99	99	89	91	88	86	86
11	1527372	70	MALE	3	PE	phenylephrine	108	111	116	111	138	142	142	140	112	168	76	78	78	77	96	98	98	98	97	96	97	97	112	113	117	110	111
12	1534690	68	MALE	3	PE	phenylephrine	70	71	71	71	145	149	145	145	116	174	62	60	63	62	91	92	91	91	93	92	93	93	80	76	72	71	70
13	1549213	63	MALE	2	PE	phenylephrine	81	80	80	80	133	134	132	133	106	159	86	88	84	86	102	103	100	102	100	100	100	100	79	79	77	79	81
14	1521289	70	FEMALE	3	PE	phenylephrine	78	79	78	78	163	161	158	160	128	192	98	99	97	98	120	120	117	119	100	99	98	99	78	77	77	77	78
15	1537294	86	FEMALE	2	NE	norepinephrine	69	72	68	69	128	125	128	127	101	152	67	64	66	65	87	87	86	87	95	95	95	95	71	72	74	74	74
16	1549844	67	MALE	3	PE	phenylephrine	88	90	91	89	148	144	146	146	116	175	79	84	82	81	102	104	103	103	100	98	98	98	92	93	93	94	96
17	1511935	84	FEMALE	3	PE	phenylephrine	68	72	70	70	165	171	178	171	136	205	98	101	102	100	120	124	127	124	96	96	96	96	69	64	60	62	64
18	1531684	62	MALE	3	NE	norepinephrine	85	85	85	85	130	134	128	130	104	156	84	84	81	83	103	105	101	103	99	100	100	100	70	72	72	74	76
19	1549275	64	FEMALE	2	PE	phenylephrine	89	88	86	87	118	115	117	116	92	139	72	69	71	70	87	84	86	85	98	98	99	98	88	88	90	90	91
20	1538384	99	MALE	2	PE	phenylephrine	62	61	62	62	144	142	144	143	114	171	60	61	60	60	88	88	88	88	99	99	99	99	62	62	61	60	61
21	899898	61	MALE	2	PE	phenylephrine	78	76	76	76	128	132	133	131	104	157	82	78	81	80	97	96	98	97	100	100	100	100	78	76	76	78	78
22	1526494	70	FEMALE	3	NE	norepinephrine	82	82	81	82	148	145	146	146	116	175	72	71	70	71	97	96	95	96	100	99	99	99	81	80	80	80	81
23	1512625	65	MALE	2	NE	norepinephrine	85	82	88	85	139	142	140	140	112	168	78	81	82	80	98	101	101	100	100	100	100	100	82	81	80	82	85
24	1554240	70	MALE	3	PE	phenylephrine	86	84	83	84	158	154	156	156	124	187	82	80	84	82	107	105	108	107	100	100	100	100	80	78	78	81	81
25	1544242	69	MALE	1	PE	phenylephrine	86	86	85	86	150	153	154	152	121	182	64	63	67	64	92	93	96	93	100	100	100	100	86	78	75	72	72
26	1545175	63	FEMALE	3	NE	norepinephrine	86	84	86	86	148	152	154	151	120	181	70	71	74	71	91	94	97	97	100	100	100	100	86	86	86	84	84
27	1542457	84	FEMALE	2	NE	norepinephrine	80	80	80	80	176	174	175	175	140	210	63	60	61	61	100	98	99	99	98	98	100	100	76	79	78	79	79

Sr.No.	MRD No.	AGE	SEX	ASA Grade	GROUP	Study solution	HR_1 Min	HR_2 Min	HR_3 Min	Mean HR	SBP_1 Min	SBP_2 Min	SBP_3 Min	Mean SBP	80% of SBP	120% of SBP	DBP_1 Min	DBP_2 Min	DBP_3 Min	Mean DBP	MAP_1 Min	MAP_2 Min	MAP_3 Min	Mean MAP	SpO2_1 Min	SpO2_2 Min	SpO2_3 Min	Mean SpO2	HR_2 Min	HR_4 Min	HR_6 Min	HR_8 Min	HR_10 Min
28	1545170	62	FEMALE	3	PE	phenylephrine	80	80	82	80	121	124	122	122	97	146	70	78	76	74	87	93	91	90	98	100	100	100	84	81	83	76	79
29	1545590	66	MALE	3	PE	phenylephrine	112	111	112	112	147	135	137	139	111	166	88	73	77	79	108	94	97	99	100	100	100	100	114	115	112	111	112
30	1546329	88	FEMALE	2	PE	phenylephrine	80	82	82	82	139	134	137	136	108	163	66	62	65	64	90	86	89	88	98	98	98	98	80	76	72	66	63
31	1547376	72	FEMALE	3	PE	phenylephrine	85	86	86	86	159	153	156	156	124	187	90	87	88	88	113	109	111	111	100	100	100	100	88	90	91	86	86
32	193679	63	FEMALE	3	NE	norepinephrine	82	81	82	82	152	156	153	153	122	183	78	76	73	75	103	103	100	101	99	99	98	99	78	76	72	72	70
33	1526494	70	FEMALE	3	NE	norepinephrine	89	91	87	89	177	174	171	174	139	208	93	96	98	95	121	122	122	121	100	99	99	99	92	91	90	90	88
34	1526792	65	FEMALE	2	PE	phenylephrine	82	78	77	79	138	136	135	136	108	163	75	73	72	73	96	94	93	94	99	99	99	99	82	81	80	80	80
35	351320	77	MALE	3	PE	phenylephrine	80	80	80	80	124	121	122	122	97	146	76	74	74	74	94	90	90	90	98	98	98	98	80	82	82	85	83
36	1108043	65	MALE	2	PE	phenylephrine	80	79	79	79	151	150	152	151	120	180	93	92	94	93	112	111	113	112	96	96	96	96	77	78	77	77	76
37	1679277	73	MALE	2	PE	phenylephrine	98	91	96	91	128	132	132	130	104	156	66	68	68	67	86	88	88	88	98	99	98	98	92	93	97	97	100
38	1685029	70	MALE	3	NE	norepinephrine	80	80	80	80	130	128	130	129	103	154	88	86	90	88	102	100	103	102	98	98	98	98	80	82	83	90	91
39	987343	74	MALE	3	NE	norepinephrine	82	88	85	85	145	149	143	145	116	174	73	75	71	73	97	99	95	97	99	100	100	100	86	85	85	86	85
40	1691186	69	MALE	3	NE	norepinephrine	90	92	90	90	140	138	140	139	111	166	98	96	100	98	112	118	113	114	98	98	98	98	90	86	85	86	87
41	1653547	89	MALE	2	PE	phenylephrine	88	89	88	88	143	141	145	143	114	171	62	64	63	63	89	90	90	90	97	96	97	97	88	87	85	88	88
42	1646522	87	MALE	3	PE	phenylephrine	82	78	77	79	138	136	135	136	108	163	75	73	72	73	96	94	93	94	99	99	99	99	82	81	80	80	80
43	1700378	95	FEMALE	3	NE	norepinephrine	72	78	75	75	130	134	128	130	104	156	58	60	56	58	82	84	80	82	98	98	97	98	78	79	80	81	78
44	1686915	62	FEMALE	3	PE	phenylephrine	98	91	96	95	148	152	152	150	120	180	86	88	88	87	106	108	108	108	96	97	97	97	95	96	97	97	96
45	479491	67	FEMALE	3	PE	phenylephrine	102	101	102	102	137	125	127	129	103	154	78	63	67	69	98	84	87	89	100	99	99	99	104	105	102	101	102
46	1698097	61	MALE	2	NE	norepinephrine	94	94	94	94	148	146	147	147	117	176	64	68	67	66	92	94	94	94	95	95	96	95	93	92	91	91	91
47	63188	75	FEMALE	2	PE	phenylephrine	88	92	90	90	135	141	148	141	112	169	68	71	72	70	90	94	97	94	99	100	100	100	90	92	92	88	86
48	1580320	63	FEMALE	2	PE	phenylephrine	88	89	88	88	143	141	145	143	114	171	62	64	63	63	89	90	90	90	97	96	97	97	88	87	85	88	88
49	1531406	78	FEMALE	3	NE	norepinephrine	82	84	82	82	134	132	134	133	106	159	92	90	94	92	106	104	107	105	98	98	97	98	78	75	75	78	74
50	1023121	86	FEMALE	3	NE	norepinephrine	110	109	111	110	108	110	106	108	86	129	62	61	60	61	77	78	75	76	100	100	100	100	108	110	111	108	106
51	1646069	77	FEMALE	3	PE	phenylephrine	72	73	73	73	177	174	174	174	139	208	74	72	73	73	108	106	106	107	100	100	100	100	74	73	72	72	72
52	1536835	73	MALE	3	PE	phenylephrine	95	93	94	94	152	151	150	151	120	181	88	87	82	85	109	108	105	107	96	97	97	97	93	92	92	92	91
53	1640998	85	MALE	3	NE	norepinephrine	72	70	72	72	131	132	132	132	105	158	78	74	76	74	92	93	95	93	100	100	98	100	68	69	72	72	70
54	1682229	65	MALE	3	PE	phenylephrine	90	90	90	90	142	141	140	141	112	169	78	77	72	75	99	98	95	97	100	99	100	100	90	88	86	86	85

Sr.No.	MRD No.	AGE	SEX	ASA Grade	GROUP	Study solution	HR_1 Min	HR_2 Min	HR_3 Min	Mean HR	SBP_1 Min	SBP_2 Min	SBP_3 Min	Mean SBP	80% of SBP	120% of SBP	DBP_1 Min	DBP_2 Min	DBP_3 Min	Mean DBP	MAP_1 Min	MAP_2 Min	MAP_3 Min	Mean MAP	SpO2_1 Min	SpO2_2 Min	SpO2_3 Min	Mean SpO2	HR_2 Min	HR_4 Min	HR_6 Min	HR_8 Min	HR_10 Min
55	1688516	70	MALE	2	NE	norepinephrine	73	74	73	73	123	121	123	123	98	147	82	79	84	82	96	94	97	95	100	99	100	100	78	76	75	74	74
56	1529247	66	MALE	2	PE	phenylephrine	64	66	64	65	147	143	142	144	115	172	95	95	96	95	112	111	111	111	97	97	97	97	66	66	64	64	62
57	1645266	60	MALE	2	PE	phenylephrine	72	73	73	73	177	174	174	174	139	208	74	72	73	73	108	106	106	107	100	100	100	100	74	73	72	72	72
58	1635946	74	MALE	2	NE	norepinephrine	84	78	81	81	122	118	121	120	96	144	84	78	81	81	96	91	94	94	100	99	100	100	84	84	82	82	81
59	1675053	95	FEMALE	3	PE	phenylephrine	80	81	81	81	147	144	149	146	116	175	81	79	80	80	105	101	103	102	99	98	99	99	82	82	80	80	80
60	1674973	93	MALE	3	NE	norepinephrine	83	83	82	83	129	127	129	128	102	153	87	85	89	87	101	99	102	100	98	98	98	98	84	85	85	88	88
61	1645782	88	FEMALE	3	PE	phenylephrine	81	80	80	80	133	134	132	133	106	159	86	88	84	86	102	103	100	102	100	100	100	100	79	79	77	79	81
62	1637661	60	MALE	2	NE	norepinephrine	79	81	81	81	129	127	129	128	102	153	87	85	89	87	101	99	102	100	100	100	99	100	79	75	74	71	72
63	1116223	68	MALE	3	NE	norepinephrine	73	75	74	74	119	117	119	118	94	141	77	75	79	77	91	89	92	90	99	100	100	100	71	71	70	70	68
64	1726585	71	FEMALE	2	NE	norepinephrine	92	94	95	94	172	175	171	172	137	206	100	93	91	94	124	120	18	120	98	99	99	99	91	92	93	94	94
65	1685321	65	MALE	3	PE	phenylephrine	78	82	80	80	145	151	158	151	120	181	78	81	82	80	100	104	107	104	99	98	98	98	79	74	70	72	74
66	1675048	74	FEMALE	3	PE	phenylephrine	68	72	70	70	165	171	178	171	136	205	98	101	102	100	120	124	127	124	100	100	100	100	72	70	70	70	71
67	1636451	75	MALE	3	NE	norepinephrine	90	90	92	91	146	143	142	144	115	172	96	95	96	95	112	111	111	111	96	96	96	96	91	93	94	94	94
68	1641206	60	MALE	2	NE	norepinephrine	72	70	72	72	131	132	132	132	105	158	78	74	76	74	92	93	95	93	100	100	98	100	68	69	72	72	70
69	1646636	79	MALE	3	PE	phenylephrine	82	78	77	79	138	136	135	136	108	163	75	73	72	73	96	94	93	94	99	99	99	99	82	81	80	80	80
70	1688931	77	MALE	3	NE	norepinephrine	72	74	72	72	124	122	124	123	98	147	82	80	84	82	96	94	97	95	99	99	100	99	78	75	74	74	72
71	1681323	62	FEMALE	3	PE	phenylephrine	74	74	74	74	158	156	160	158	126	189	77	79	78	78	104	105	105	105	100	99	99	99	76	75	74	72	71
72	1450177	61	FEMALE	2	NE	norepinephrine	73	74	74	74	150	150	150	150	120	180	92	92	93	92	111	111	111	111	100	100	100	100	72	72	73	73	72
73	1531333	73	MALE	3	NE	norepinephrine	92	94	92	92	144	142	144	143	114	171	102	100	104	102	116	114	117	115	97	96	97	97	78	75	75	78	74
74	1651610	76	MALE	2	PE	phenylephrine	72	73	73	73	177	174	174	174	139	208	74	72	73	73	108	106	106	107	100	100	100	100	74	73	72	72	72
75	1645782	62	FEMALE	2	PE	phenylephrine	81	80	80	80	133	134	132	133	106	159	86	88	84	86	102	103	100	102	100	100	100	100	79	79	77	79	81
76	65848	89	MALE	2	NE	norepinephrine	110	109	111	110	108	110	106	108	86	129	62	61	60	61	77	78	75	76	100	100	100	100	108	110	111	108	106
77	1686262	70	FEMALE	2	NE	norpeinephrine	98	100	104	100	144	138	132	138	110	165	68	66	64	66	93	90	87	90	100	99	100	100	98	98	96	97	97
78	111467	65	FEMALE	2	PE	phenylephrine	81	80	80	80	133	134	132	133	106	159	86	88	84	86	102	103	100	102	100	100	100	100	79	79	77	79	81
79	1683030	65	FEMALE	2	PE	phenylephrine	68	72	70	70	155	161	168	161	128	193	88	91	92	90	110	114	117	114	96	97	97	97	69	64	60	62	64
80	1610359	76	FEMALE	2	PE	phenylephrine	85	84	84	84	148	146	150	148	118	177	67	69	68	68	94	95	95	95	100	100	100	100	81	81	80	82	83
81	1641804	90	MALE	2	NE	norepinephrine	84	78	81	81	122	118	121	120	96	144	84	78	81	81	96	91	94	94	100	99	100	100	84	84	82	82	81

Sr.No.	MRD No.	AGE	SEX	ASA Grade	GROUP	Study solution	HR_1 Min	HR_2 Min	HR_3 Min	Mean HR	SBP_1 Min	SBP_2 Min	SBP_3 Min	Mean SBP	80% of SBP	120% of SBP	DBP_1 Min	DBP_2 Min	DBP_3 Min	Mean DBP	MAP_1 Min	MAP_2 Min	MAP_3 Min	Mean MAP	SpO2_1 Min	SpO2_2 Min	SpO2_3 Min	Mean SpO2	HR_2 Min	HR_4 Min	HR_6 Min	HR_8 Min	HR_10 Min
82	163496	68	FEMALE	2	NE	norepinephrine	80	80	80	80	176	174	175	175	140	210	63	60	61	61	100	98	99	99	98	98	100	100	76	79	78	79	79
83	549210	60	FEMALE	3	NE	norepinephrine	72	78	75	75	150	154	148	150	120	180	78	80	76	78	102	104	100	102	98	98	98	98	76	78	79	79	78
84	1588284	68	MALE	2	NE	norepinephrine	60	58	60	59	142	138	140	140	116	168	82	84	84	82	102	102	101	102	100	100	100	100	60	62	62	61	63
85	1637674	60	FEMALE	2	NE	norepinephrine	82	80	80	80	133	131	132	132	105	158	72	73	74	73	92	92	92	92	100	96	100	100	80	81	80	83	84
86	1652937	72	MALE	3	PE	phenylephrine	78	78	77	78	155	161	168	161	128	193	88	91	92	90	110	114	117	114	98	99	99	99	78	80	81	82	82
87	1649738	75	MALE	2	PE	phenylephrine	72	73	73	73	177	174	174	174	139	208	74	72	73	73	108	106	106	107	100	100	100	100	74	73	72	72	72
88	1639824	66	MALE	2	NE	norepinephrine	72	70	72	72	131	132	132	132	105	158	78	74	76	74	92	93	95	93	100	100	98	100	68	69	72	72	70
89	1535209	73	MALE	3	PE	phenylephrine	66	66	65	66	124	120	122	123	98	147	75	74	74	74	94	90	90	90	99	99	100	99	65	64	64	65	66
90	245275	69	MALE	3	NE	norepinephrine	110	109	111	110	108	110	106	108	86	129	62	61	60	61	77	78	75	76	100	100	100	100	108	110	111	108	106
91	358274	73	MALE	3	NE	norepinephrine	73	75	74	74	119	117	119	118	94	141	77	75	79	77	91	89	92	90	99	100	100	100	71	71	70	70	68
92	58061	69	FEMALE	2	NE	norepinephrine	84	78	81	81	122	118	121	120	96	144	84	78	81	81	96	91	94	94	100	99	100	100	84	84	82	82	81
93	1645228	75	FEMALE	2	PE	phenylephrine	72	73	73	73	177	174	174	174	139	208	74	72	73	73	108	106	106	107	100	100	100	100	74	73	72	72	72
94	965351	86	FEMALE	3	PE	phenylephrine	82	78	77	79	138	136	135	136	108	163	75	73	72	73	96	94	93	94	99	99	99	99	82	81	80	80	80
95	1533225	73	MALE	3	NE	norepinephrine	90	90	92	91	146	143	142	144	115	172	96	95	96	95	112	111	111	111	96	96	96	96	91	93	94	94	94
96	1682490	68	MALE	3	PE	phenylephrine	72	74	74	74	172	171	170	171	136	205	108	107	102	105	129	128	125	127	100	99	99	100	73	74	74	75	74
97	596147	60	FEMALE	2	PE	phenylephrine	81	80	80	80	133	134	132	133	106	159	86	88	84	86	102	103	100	102	100	100	100	100	79	79	77	79	81
98	622215	68	MALE	1	NE	norepinephrine	79	79	80	79	142	138	140	140	112	168	90	86	88	88	107	103	105	105	97	97	97	98	82	80	80	76	76
99	1688486	61	MALE	2	PE	phenylephrine	82	84	84	84	152	151	150	151	120	181	88	87	82	85	109	108	105	107	98	97	97	97	83	85	85	84	82
100	1647823	80	FEMALE	3	PE	phenylephrine	72	73	73	73	177	174	174	174	139	208	74	72	73	73	108	106	106	107	100	100	100	100	74	73	72	72	72
101	1644175	60	FEMALE	2	NE	norepinephrine	110	109	111	110	108	110	106	108	86	129	62	61	60	61	77	78	75	76	100	100	100	100	108	110	111	108	106
102	1724342	90	FEMALE	3	NE	norepinephrine	72	72	73	72	151	149	153	152	121	182	81	83	81	81	104	105	105	105	100	100	99	100	72	71	73	72	72
103	1651914	71	FEMALE	2	PE	phenylephrine	88	89	88	88	143	141	145	143	114	171	62	64	63	63	89	90	90	90	97	96	97	97	88	87	85	88	88
104	1556852	77	FEMALE	3	PE	phenylephrine	68	69	68	68	152	155	155	154	123	184	70	73	71	71	97	100	99	99	96	96	97	96	69	71	68	68	67
105	549219	60	FEMALE	3	NE	norepinephrine	70	72	72	71	138	142	142	140	112	168	76	78	78	77	96	98	98	98	100	99	99	99	71	71	72	70	70
106	1674973	93	MALE	3	NE	norepinephrine	68	70	70	70	118	122	122	120	96	144	56	58	58	57	76	78	78	78	100	99	100	100	68	69	67	68	68
107	1680753	66	MALE	3	PE	phenylephrine	82	84	84	84	162	161	160	161	128	193	98	97	92	95	119	118	115	117	96	97	97	97	83	84	84	85	85
108	1709608	84	FEMALE	3	NE	norepinephrine	108	110	114	110	154	148	142	148	118	177	78	76	74	76	103	100	97	100	100	99	100	100	110	108	109	110	111

Sr.No.	MRD No.	AGE	SEX	ASA Grade	GROUP	Study solution	HR_1 Min	HR_2 Min	HR_3 Min	Mean HR	SBP_1 Min	SBP_2 Min	SBP_3 Min	Mean SBP	80% of SBP	120% of SBP	DBP_1 Min	DBP_2 Min	DBP_3 Min	Mean DBP	MAP_1 Min	MAP_2 Min	MAP_3 Min	Mean MAP	SpO2_1 Min	SpO2_2 Min	SpO2_3 Min	Mean SpO2	HR_2 Min	HR_4 Min	HR_6 Min	HR_8 Min	HR_10 Min
109	1416589	64	MALE	3	NE	norepinephrine	79	81	81	81	129	127	129	128	102	153	87	85	89	87	101	99	102	100	100	100	99	100	79	75	74	71	72
110	58061	68	FEMALE	2	NE	norepinephrine	72	78	75	75	160	164	158	160	128	192	88	90	86	88	112	114	110	112	98	97	98	98	76	78	79	71	72
111	1658791	70	MALE	3	PE	phenylephrine	76	77	76	76	134	136	140	136	108	163	85	88	89	87	99	105	104	103	100	100	100	100	76	76	76	76	75
112	1677435	90	MALE	3	NE	norepinephrine	84	84	84	84	158	156	157	157	125	188	74	78	77	76	102	104	104	104	94	95	96	95	88	85	84	82	81
113	1532290	60	FEMALE	2	PE	phenylephrine	72	73	73	73	177	174	174	174	139	208	74	72	73	73	108	106	106	107	100	100	100	100	74	73	72	72	72
114	1652611	62	FEMALE	3	PE	phenylephrine	66	66	65	66	124	120	122	123	98	147	75	74	74	74	94	90	90	90	99	99	100	99	65	64	64	65	66
115	1694854	74	FEMALE	3	NE	norepinephrine	73	73	72	73	130	128	129	128	102	153	88	85	89	87	102	99	102	100	98	98	98	98	85	85	84	83	82
116	1680902	70	FEMALE	2	PE	phenylephrine	85	84	84	84	138	136	140	138	110	165	57	59	58	58	84	85	85	85	100	100	100	100	81	81	80	82	83
117	1667201	79	MALE	3	NE	norepinephrine	68	70	70	70	119	122	122	120	96	144	57	59	58	57	76	78	78	78	100	100	100	100	68	71	72	74	73
118	235044	83	FEMALE	3	PE	phenylephrine	82	83	83	83	142	141	140	141	112	169	78	77	72	75	99	98	95	97	98	99	99	99	89	91	88	86	87
119	1675053	95	FEMALE	3	NE	norepinephrine	88	86	86	86	120	132	130	127	101	152	58	69	67	64	79	88	88	85	100	100	100	100	88	86	88	85	84
120	1681983	75	MALE	1	PE	phenylephrine	68	72	70	70	160	166	173	166	132	199	93	96	97	95	115	119	122	119	97	97	96	97	72	70	72	71	71
121	1558975	84	MALE	3	PE	phenylephrine	82	84	84	84	172	171	170	171	136	205	108	107	102	105	129	128	125	127	97	96	96	96	85	86	86	87	88
122	1531361	74	MALE	2	NE	norepinephrine	78	76	78	78	138	134	136	136	108	163	86	82	84	84	103	99	101	101	98	97	97	97	78	76	76	77	77
123	1630554	76	FEMALE	3	NE	norepinephrine	79	81	81	81	129	127	129	128	102	153	87	85	89	87	101	99	102	100	100	100	99	100	79	75	74	71	72
124	1637508	65	FEMALE	2	PE	phenylephrine	72	73	73	73	177	174	174	174	139	208	74	72	73	73	108	106	106	107	100	100	100	100	74	73	72	72	72
125	1658552	80	FEMALE	3	PE	phenylephrine	89	88	88	88	144	146	141	143	114	171	96	97	99	97	112	113	113	112	100	100	100	100	91	93	89	85	85
126	1559030	81	MALE	2	NE	norepinephrine	89	91	91	90	177	175	173	175	140	210	74	72	73	73	108	106	106	107	100	100	100	100	93	92	93	94	94
127	1656869	75	FEMALE	2	PE	phenylephrine	72	73	73	73	177	174	174	174	139	208	74	72	73	73	108	106	106	107	100	100	100	100	74	73	72	72	72
128	1690818	74	MALE	3	NE	norepinephrine	72	74	72	72	124	121	124	123	98	147	82	79	83	82	96	94	97	95	99	97	99	99	74	75	74	72	71
129	117996	61	MALE	1	PE	phenylephrine	91	92	92	92	120	128	125	124	99	148	70	72	75	72	87	91	92	90	99	99	99	99	89	92	88	87	83
130	428042	71	MALE	3	PE	phenylephrine	76	77	76	76	134	136	140	136	108	163	85	88	89	87	99	105	104	103	100	100	100	100	76	76	76	76	75
131	1691229	73	MALE	2	NE	norepinephrine	80	80	80	80	135	133	133	132	105	158	92	90	94	91	106	104	107	105	98	98	98	98	78	75	79	80	82
132	1078285	74	MALE	3	PE	phenylephrine	89	88	88	88	144	146	141	143	114	171	96	97	99	97	112	113	113	112	100	100	100	100	91	93	89	85	85
133	1644815	90	FEMALE	3	NE	norepinephrine	79	81	81	81	129	127	129	128	102	153	87	85	89	87	101	99	102	100	100	100	99	100	79	75	74	71	72
134	1643764	65	FEMALE	3	NE	norepinephrine	72	72	73	72	151	149	153	152	121	182	81	83	81	81	104	105	105	105	100	100	99	100	72	71	73	72	72

Sr.No.	HR_12 Min	HR_14 Min	HR_16 Min	HR_18 Min	HR_20 Min	HR_22 Min	HR_24 Min	HR_26 Min	HR_28 Min	HR_30 Min	HR_32 Min	HR_34 Min	HR_36 Min	HR_38 Min	HR_40 Min	HR_42 Min	HR_44 Min	IASBP_2 Min	IASBP_4 Min	IASBP_6 Min	IASBP_8 Min	IASBP_10 Min	IASBP_12 Min	IASBP_14 Min	IASBP_16 Min	IASBP_18 Min	IASBP_20 Min	IASBP_22 Min	IASBP_24 Min	IASBP_26 Min	IASBP_28 Min	IASBP_30 Min	IASBP_32 Min	IASBP_34 Min
1	87	93	88	85	86	85	85	85	85	84	83	84	83	83	83	82	81	182	215	210	235	199	184	180	177	174	170	165	163	154	150	152	148	150
2	63	62	61	68	65	65	63	61	63	62	62	62	61	63	63	62	62	146	142	138	140	142	136	138	135	135	140	140	138	135	138	140	138	135
3	77	77	78	78	75	75	78	77	77	75	72	75	73	73	73	75	74	134	138	144	148	150	147	142	138	132	131	132	131	129	129	130	133	132
4	81	80	84	86	88	89	89	85	81	79	77	79	78	78	79	81	79	112	118	120	118	122	121	126	128	126	125	123	124	122	124	120	121	123
5	69	72	69	68	66	64	62	66	68	68	70	70	71	69	71	70	70	113	104	98	130	134	136	144	145	148	152	155	146	140	134	136	132	131
6	74	76	72	72	73	72	78	77	78	78	72	72	75	75	72	72	72	96	94	100	102	110	118	124	135	144	145	141	130	122	118	116	115	112
7	72	73	74	75	75	75	71	70	68	72	71	71	73	74	74	70	72	122	128	129	133	131	132	133	127	131	132	131	133	132	127	126	133	127
8	84	86	85	85	83	81	80	80	83	83	83	81	82	82	80	84	84	124	122	128	129	132	130	131	133	129	131	133	132	131	127	126	128	133
9	82	86	88	94	90	92	91	99	93	97	96	95	95	92	90	91	90	90	98	99	102	109	104	110	112	110	108	112	106	104	112	109	118	116
10	87	90	93	112	120	108	98	98	94	107	92	90	88	86	87	87	88	140	138	137	139	141	136	128	121	106	104	138	137	139	136	132	133	131
11	107	118	117	117	115	114	115	115	116	115	112	111	117	116	118	117	112	134	132	125	121	126	121	107	128	132	138	134	133	136	126	129	131	127
12	72	68	67	68	65	66	67	67	67	66	65	65	68	68	65	64	66	149	144	142	134	148	151	156	155	149	149	152	151	149	145	138	148	145
13	81	80	80	82	82	81	81	80	80	78	78	79	79	80	80	81	81	136	138	131	126	124	125	128	130	132	131	129	132	133	135	136	134	132
14	78	77	79	79	80	80	81	79	79	78	78	78	77	78	77	78	78	158	153	149	151	152	152	158	155	148	52	150	151	151	153	153	156	157
15	73	73	71	71	69	69	68	72	72	73	71	71	72	72	74	74	73	128	120	98	99	114	117	118	120	123	125	130	128	124	125	128	120	123
16	96	92	90	89	89	88	88	91	91	90	90	91	91	88	89	88	88	141	135	136	138	142	141	144	44	142	146	143	138	138	140	140	139	141
17	65	65	65	64	63	66	68	69	70	72	74	78	72	72	71	70	70	158	150	138	124	137	138	138	141	142	148	148	149	150	150	151	153	153
18	79	80	81	82	82	80	79	78	78	78	77	78	78	78	76	76	78	118	126	128	127	125	124	129	127	126	128	130	125	131	122	125	120	120
19	89	89	88	87	87	88	89	89	90	90	88	89	89	90	90	91	91	110	118	119	122	122	118	116	115	112	118	122	118	116	118	121	124	126
20	62	63	64	64	63	62	65	66	65	66	67	67	64	63	64	62	62	150	166	161	168	165	168	166	162	158	155	157	161	160	162	159	153	150
21	78	76	77	75	76	75	75	76	76	78	78	76	76	74	78	78	78	139	138	141	142	146	145	144	138	138	137	135	141	138	136	141	143	142
22	81	81	82	82	82	80	80	79	79	78	80	80	81	79	78	79	79	145	143	138	133	131	131	133	134	136	135	138	136	19	141	140	139	143
23	81	83	78	79	80	80	79	81	82	78	82	82	83	79	79	81	80	139	130	124	108	102	113	119	121	120	124	122	118	120	123	125	133	132
24	80	80	84	86	86	86	84	84	86	86	84	82	82	82	82	82	82	139	136	136	144	149	146	147	135	142	144	139	144	145	144	139	136	139
25	68	69	65	67	65	66	64	64	65	64	64	64	68	68	68	69	69	152	124	119	111	116	121	121	131	136	132	124	122	140	136	132	136	133
26	85	85	84	82	81	85	80	86	87	80	80	83	83	88	90	90	86	150	135	132	153	163	164	167	164	171	159	153	152	151	148	152	156	163
27	80	79	79	77	78	77	76	76	76	75	74	75	76	75	73	72	71	166	158	156	161	164	169	164	162	160	153	155	152	151	151	150	149	151

Sr.No.	HR_12 Min	HR_14 Min	HR_16 Min	HR_18 Min	HR_20 Min	HR_22 Min	HR_24 Min	HR_26 Min	HR_28 Min	HR_30 Min	HR_32 Min	HR_34 Min	HR_36 Min	HR_38 Min	HR_40 Min	HR_42 Min	HR_44 Min	IASBP_2 Min	IASBP_4 Min	IASBP_6 Min	IASBP_8 Min	IASBP_10 Min	IASBP_12 Min	IASBP_14 Min	IASBP_16 Min	IASBP_18 Min	IASBP_20 Min	IASBP_22 Min	IASBP_24 Min	IASBP_26 Min	IASBP_28 Min	IASBP_30 Min	IASBP_32 Min	IASBP_34 Min
28	79	79	77	75	77	75	73	75	76	76	74	75	75	75	76	76	77	100	102	104	100	105	108	112	104	115	118	112	102	110	110	113	114	120
29	111	112	108	106	106	108	105	106	107	108	107	109	109	106	108	107	108	127	106	99	113	115	116	118	118	115	118	118	114	121	117	112	111	118
30	63	66	61	60	62	61	62	63	69	74	75	75	76	76	74	73	72	129	127	117	122	116	118	125	123	121	123	118	115	112	116	124	127	132
31	85	85	86	89	89	91	92	91	90	90	90	91	93	91	89	88	89	153	141	138	142	148	150	143	141	150	157	157	152	159	161	156	158	158
32	71	71	69	67	68	68	68	71	71	71	74	73	74	73	75	74	71	133	134	118	102	124	133	131	129	128	123	128	132	131	132	126	129	130
33	88	89	91	91	92	90	90	89	88	88	91	91	89	88	87	87	88	169	163	152	141	134	139	144	142	141	142	145	145	148	149	150	151	151
34	8	79	79	77	78	79	79	77	77	78	77	78	78	77	79	79	77	132	124	122	121	120	118	119	123	125	128	131	132	133	134	135	138	136
35	81	81	80	86	84	84	83	83	85	86	82	83	84	84	84	86	86	124	116	121	122	140	136	133	118	119	120	119	120	124	128	130	131	129
36	76	77	79	79	80	81	83	83	83	82	76	77	76	75	74	74	74	143	146	149	151	153	155	156	154	151	146	143	140	143	144	145	147	153
37	98	99	100	100	97	96	95	94	98	97	91	90	91	91	93	95	97	124	122	115	111	116	111	98	118	122	128	124	123	126	116	119	121	117
38	93	83	84	85	86	87	87	88	88	88	90	90	90	90	90	90	90	130	140	140	150	155	155	144	140	146	148	151	145	145	136	138	141	142
39	85	85	84	83	84	83	82	83	80	80	86	87	88	88	85	83	82	157	190	185	210	174	159	155	152	149	145	140	138	129	125	127	123	125
40	88	88	90	91	91	90	92	92	87	89	90	93	93	95	96	96	92	140	150	150	160	165	174	170	166	158	162	161	145	145	146	148	151	152
41	89	91	91	90	92	92	89	88	87	88	92	92	93	92	92	91	90	89	131	130	130	129	130	133	131	133	133	130	129	128	130	125	130	128
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43	81	83	79	83	79	78	77	82	84	85	85	83	72	77	73	71	75	142	175	170	195	159	144	140	137	134	130	125	123	114	110	112	104	102
44	93	92	90	91	90	91	92	92	92	91	93	94	94	95	95	96	95	144	142	135	131	136	131	117	138	142	148	144	143	146	136	139	141	137
45	101	101	102	98	96	95	96	97	98	99	102	101	97	95	92	91	91	117	96	90	103	105	106	108	105	108	108	104	111	107	102	101	102	108
46	92	92	92	93	94	93	95	96	95	96	93	93	92	90	93	93	93	152	154	169	178	185	205	185	180	165	158	159	162	154	148	147	144	140
47	84	85	83	85	85	87	88	88	86	90	91	92	92	93	92	90	90	128	120	108	94	107	108	108	111	112	118	118	119	120	120	121	123	123
48	89	91	91	90	92	92	89	88	87	88	92	92	93	92	92	91	90	89	131	130	130	129	130	133	131	133	133	130	129	128	130	125	130	128
49	78	77	76	77	75	78	78	78	76	78	75	74	75	74	75	74	74	134	144	154	159	160	157	152	151	152	151	139	139	140	141	142	143	142
50	106	107	108	109	110	111	111	110	107	108	109	109	110	108	110	111	111	110	112	115	114	108	108	110	111	109	115	121	120	119	121	118	118	119
51	71	71	70	73	73	72	74	76	76	76	77	78	73	74	75	74	74	177	170	156	148	152	153	154	166	168	162	158	160	157	150	155	156	157
52	91	90	93	93	89	89	91	90	90	90	93	93	93	93	92	92	92	151	153	154	155	158	162	162	160	163	167	160	156	158	155	154	151	147
53	72	73	74	75	75	75	71	70	68	72	71	71	73	74	74	70	72	122	128	129	133	131	132	133	127	131	132	131	133	132	127	126	133	127
54	84	86	90	91	91	85	88	89	89	87	90	90	88	90	88	89	87	130	128	127	129	131	126	128	121	96	94	128	127	129	126	122	123	121

Sr.No.	HR_12 Min	HR_14 Min	HR_16 Min	HR_18 Min	HR_20 Min	HR_22 Min	HR_24 Min	HR_26 Min	HR_28 Min	HR_30 Min	HR_32 Min	HR_34 Min	HR_36 Min	HR_38 Min	HR_40 Min	HR_42 Min	HR_44 Min	IASBP_2 Min	IASBP_4 Min	IASBP_6 Min	IASBP_8 Min	IASBP_10 Min	IASBP_12 Min	IASBP_14 Min	IASBP_16 Min	IASBP_18 Min	IASBP_20 Min	IASBP_22 Min	IASBP_24 Min	IASBP_26 Min	IASBP_28 Min	IASBP_30 Min	IASBP_32 Min	IASBP_34 Min
55	72	72	76	76	77	78	75	77	78	79	80	75	76	76	77	78	77	123	135	145	148	150	146	143	140	142	142	128	129	130	130	131	134	133
56	63	65	65	67	68	68	67	66	67	67	66	66	66	67	69	69	67	145	132	135	138	139	138	134	133	143	141	144	142	145	144	143	148	150
57	71	71	70	73	73	72	74	76	76	76	77	78	73	74	75	74	74	177	170	156	148	152	153	154	166	168	162	158	160	157	150	155	156	157
58	81	80	84	86	88	89	89	85	81	79	77	79	78	78	79	81	79	112	118	120	118	122	121	126	128	126	125	123	124	122	124	120	121	123
59	81	82	84	84	84	81	81	80	80	82	82	83	84	83	82	83	82	139	140	141	141	143	141	140	140	140	143	146	148	145	148	147	148	142
60	85	86	87	87	89	89	91	92	93	93	89	90	89	89	87	87	88	129	139	149	154	155	152	147	146	147	146	134	134	135	136	137	138	137
61	81	80	80	82	82	81	81	80	80	78	78	79	79	80	80	81	81	136	138	131	126	124	125	128	130	132	131	129	132	133	135	136	134	132
62	73	74	75	78	81	79	80	80	80	80	82	82	82	82	81	80	80	129	139	149	154	155	153	147	146	147	146	134	134	135	136	137	138	137
63	69	68	68	70	70	68	68	70	72	72	69	69	69	70	70	70	70	119	129	139	144	145	142	135	136	137	136	124	124	125	126	127	128	127
64	92	91	91	90	93	93	88	85	82	81	88	90	91	93	93	90	93	178	179	172	171	168	166	165	168	155	152	146	140	135	138	139	141	144
65	75	75	78	77	76	75	77	78	78	77	80	82	78	78	77	75	75	138	130	118	104	117	118	118	121	122	128	128	129	130	130	131	133	133
66	71	72	73	75	76	76	73	76	73	76	77	78	78	76	75	76	76	158	150	138	124	137	138	138	141	142	148	148	149	150	10	151	153	153
67	93	90	90	90	94	95	95	91	93	93	90	90	92	92	92	94	93	145	132	134	138	139	134	134	133	132	143	141	144	145	145	143	149	149
68	72	73	74	75	75	75	71	70	68	72	71	71	73	74	74	70	72	122	128	129	133	131	132	133	127	131	132	131	133	132	127	126	133	127
69	8	79	79	77	78	79	79	77	77	78	77	78	78	77	79	79	77	132	124	122	121	120	118	119	123	125	128	131	132	133	134	135	138	136
70	72	72	74	71	71	70	72	71	74	74	73	73	73	75	75	77	77	124	134	144	149	150	147	142	141	142	141	129	129	130	131	132	133	132
71	71	71	70	74	75	74	73	73	74	74	75	76	76	77	78	79	79	146	145	145	144	145	148	146	148	148	145	144	144	143	145	140	143	144
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73	78	77	76	77	78	75	78	78	76	77	75	74	75	74	74	74	75	144	154	164	169	170	167	162	161	162	161	149	149	150	151	152	153	152
74	71	71	70	73	73	72	74	76	76	76	77	78	73	74	75	74	74	177	170	156	148	152	153	154	166	168	162	158	160	157	150	155	156	157
75	81	80	80	82	82	81	81	80	80	78	78	79	79	80	80	81	81	136	138	131	126	124	125	128	130	132	131	129	132	133	135	136	134	132
76	106	107	108	109	110	111	111	110	107	108	109	109	110	108	110	111	111	110	112	115	114	108	108	110	111	109	115	121	120	119	121	118	118	119
77	98	99	100	99	97	96	95	93	91	90	90	90	90	90	90	90	90	140	144	148	152	154	169	178	185	168	165	158	152	154	150	147	144	140
78	81	80	80	82	82	81	81	80	80	78	78	79	79	80	80	81	81	136	138	131	126	124	125	128	130	132	131	129	132	133	135	136	134	132
79	65	65	66	66	65	63	62	68	69	70	72	74	68	72	69	68	65	148	140	128	114	127	128	128	131	132	138	138	139	140	140	141	143	143
80	83	84	82	83	83	81	81	80	82	81	80	80	79	81	82	83	83	136	135	135	134	135	138	136	138	138	135	134	134	133	135	130	133	134
81	81	80	84	86	88	89	89	85	81	79	77	79	78	78	79	81	79	112	118	120	118	122	121	126	128	126	125	123	124	122	124	120	121	123

Sr.No.	HR_12 Min	HR_14 Min	HR_16 Min	HR_18 Min	HR_20 Min	HR_22 Min	HR_24 Min	HR_26 Min	HR_28 Min	HR_30 Min	HR_32 Min	HR_34 Min	HR_36 Min	HR_38 Min	HR_40 Min	HR_42 Min	HR_44 Min	IASBP_2 Min	IASBP_4 Min	IASBP_6 Min	IASBP_8 Min	IASBP_10 Min	IASBP_12 Min	IASBP_14 Min	IASBP_16 Min	IASBP_18 Min	IASBP_20 Min	IASBP_22 Min	IASBP_24 Min	IASBP_26 Min	IASBP_28 Min	IASBP_30 Min	IASBP_32 Min	IASBP_34 Min
82	80	79	79	77	78	77	76	76	76	75	74	75	76	75	73	72	71	166	158	156	161	164	169	164	162	160	153	155	152	151	151	150	149	151
83	82	81	82	83	83	84	84	85	86	87	88	89	81	76	77	78	79	162	195	190	215	179	164	160	157	154	150	145	143	134	130	132	128	130
84	63	62	61	68	65	65	63	61	63	62	62	62	61	63	63	62	62	146	142	138	140	142	136	138	135	135	140	140	138	135	138	140	138	135
85	84	86	85	85	83	81	80	80	83	83	83	81	82	82	80	84	84	124	122	128	129	132	130	131	133	129	131	133	132	131	127	126	128	133
86	83	83	85	84	85	85	86	87	88	89	87	85	84	82	83	83	83	148	140	128	114	127	128	128	13	132	138	138	139	140	140	141	143	143
87	71	71	70	73	73	72	74	76	76	76	77	78	73	74	75	74	74	177	170	156	148	152	153	154	166	168	162	158	160	157	150	155	156	157
88	72	73	74	75	75	75	71	70	68	72	71	71	73	74	74	70	72	122	128	129	133	131	132	133	127	131	132	131	133	132	127	126	133	127
89	66	67	68	69	68	68	66	65	65	64	67	68	69	68	72	70	70	123	117	120	121	122	139	136	132	118	119	121	125	128	129	130	130	130
90	106	107	108	109	110	111	111	110	107	108	109	109	110	108	110	111	111	110	112	115	114	108	108	110	111	109	115	121	120	119	121	118	118	119
91	69	68	68	70	70	68	68	70	72	72	69	69	69	70	70	70	70	119	129	139	144	145	142	135	136	137	136	124	124	125	126	127	128	127
92	81	80	84	86	88	89	89	85	81	79	77	79	78	78	79	81	79	112	118	120	118	122	121	126	128	126	125	123	124	122	124	120	121	123
93	71	71	70	73	73	72	74	76	76	76	77	78	73	74	75	74	74	177	170	156	148	152	153	154	166	168	162	158	160	157	150	155	156	157
94	8	79	79	77	78	79	79	77	77	78	77	78	78	77	79	79	77	132	124	122	121	120	118	119	123	125	128	131	132	133	134	135	138	136
95	93	90	90	90	94	95	95	91	93	93	90	90	92	92	92	94	93	145	132	134	138	139	134	134	133	132	143	141	144	145	145	143	149	149
96	72	72	73	73	77	77	78	72	71	71	75	77	79	79	77	76	76	160	158	157	159	161	156	158	151	126	124	158	157	159	156	152	153	151
97	81	80	80	82	82	81	81	80	80	78	78	79	79	80	80	81	81	136	138	131	126	124	125	128	130	132	131	129	132	133	135	136	134	132
98	75	77	78	78	79	80	80	80	78	77	76	76	77	78	78	78	79	127	113	112	114	104	118	124	124	144	152	155	160	164	163	169	163	152
99	82	83	83	84	85	85	85	85	84	84	86	88	88	88	88	86	86	140	138	137	139	141	136	138	131	106	104	138	137	139	136	132	133	131
100	71	71	70	73	73	72	74	76	76	76	77	78	73	74	75	74	74	177	170	156	148	152	153	154	166	168	162	158	160	157	150	155	156	157
101	106	107	108	109	110	111	111	110	107	108	109	109	110	108	110	111	111	110	112	115	114	108	108	110	111	109	115	121	120	119	121	118	118	119
102	73	73	73	72	81	71	71	70	72	72	73	75	74	73	73	72	72	150	150	148	150	149	147	146	145	151	144	143	146	149	140	138	143	140
103	89	91	91	90	92	92	89	88	87	88	92	92	93	92	92	91	90	89	131	130	130	129	130	133	131	133	133	130	129	128	130	125	130	128
104	67	70	70	69	69	67	69	70	71	73	68	69	68	67	67	66	71	155	157	163	164	158	157	155	153	151	157	158	156	159	151	150	152	155
105	73	74	74	74	72	72	74	74	77	77	78	78	72	72	74	75	75	134	132	125	121	126	121	108	128	132	138	134	133	136	126	129	131	127
106	66	66	65	68	70	72	71	71	70	70	72	68	71	67	68	68	68	114	112	105	101	106	101	88	108	112	118	114	113	116	106	109	111	107
107	85	82	82	83	81	82	83	83	83	84	81	82	81	82	82	85	85	150	148	147	149	151	146	148	141	116	114	148	147	149	146	142	143	141
108	111	113	110	108	104	102	100	99	98	97	95	95	98	99	100	98	97	150	154	158	162	164	179	188	195	178	175	168	162	164	160	157	154	150

Sr.No.	HR_12 Min	HR_14 Min	HR_16 Min	HR_18 Min	HR_20 Min	HR_22 Min	HR_24 Min	HR_26 Min	HR_28 Min	HR_30 Min	HR_32 Min	HR_34 Min	HR_36 Min	HR_38 Min	HR_40 Min	HR_42 Min	HR_44 Min	IASBP_2 Min	IASBP_4 Min	IASBP_6 Min	IASBP_8 Min	IASBP_10 Min	IASBP_12 Min	IASBP_14 Min	IASBP_16 Min	IASBP_18 Min	IASBP_20 Min	IASBP_22 Min	IASBP_24 Min	IASBP_26 Min	IASBP_28 Min	IASBP_30 Min	IASBP_32 Min	IASBP_34 Min
109	73	74	75	78	81	79	80	80	80	80	82	82	82	82	81	80	80	129	139	149	154	155	153	147	146	147	146	134	134	135	136	137	138	137
110	75	77	78	75	76	75	76	77	77	77	73	74	73	73	72	71	72	172	205	200	225	189	174	170	167	164	160	155	153	144	140	142	138	140
111	74	71	72	73	73	73	71	70	70	71	76	79	78	78	79	78	78	118	134	136	140	137	133	139	135	138	134	126	118	116	119	117	117	110
112	83	84	84	85	88	86	87	86	86	85	84	85	84	85	83	84	84	162	164	179	188	195	215	195	190	175	168	169	172	164	158	157	154	150
113	71	71	70	73	73	72	74	76	76	76	77	78	73	74	75	74	74	177	170	156	148	152	153	154	166	168	162	158	160	157	150	155	156	157
114	66	67	68	69	68	68	66	65	65	64	67	68	69	68	72	70	70	123	117	120	121	122	139	136	132	118	119	121	125	128	129	130	130	130
115	82	81	81	80	80	78	79	80	80	80	84	84	85	77	78	78	78	129	139	138	149	148	154	155	148	146	146	133	134	134	136	136	136	137
116	83	84	82	80	81	80	81	81	82	84	79	78	80	81	81	80	80	126	125	125	124	125	128	126	128	128	125	124	124	123	125	120	123	124
117	71	69	70	71	70	71	722	73	68	69	74	74	73	73	74	74	73	115	111	106	102	105	101	102	88	112	117	111	113	115	114	108	110	111
118	87	90	93	97	97	95	91	91	88	88	89	89	87	91	92	89	91	130	128	127	129	131	126	118	111	96	94	128	127	129	126	122	123	121
119	82	82	82	82	81	80	80	78	78	78	78	80	80	80	80	78	78	123	127	122	128	126	116	118	100	108	112	118	120	126	122	128	130	130
120	70	71	71	72	73	75	75	73	74	74	73	71	70	70	71	70	70	153	145	133	119	132	133	133	136	137	143	143	144	145	145	146	148	148
121	88	87	86	86	85	85	85	86	86	87	88	88	87	86	86	85	85	160	158	157	159	161	156	158	151	126	124	158	157	159	156	152	153	151
122	79	72	75	79	76	74	72	76	78	78	71	71	70	72	78	76	78	123	109	104	118	120	124	134	144	148	155	164	168	163	155	152	145	144
123	73	74	75	78	81	79	80	80	80	80	82	82	82	82	81	80	80	129	139	149	154	155	153	147	146	147	146	134	134	135	136	137	138	137
124	71	71	70	73	73	72	74	76	76	76	77	78	73	74	75	74	74	177	170	156	148	152	153	154	166	168	162	158	160	157	150	155	156	157
125	87	87	88	89	89	90	90	85	88	85	84	83	83	86	87	88	88	145	142	143	141	146	145	148	143	147	151	149	150	151	155	148	150	144
126	95	91	91	92	92	94	93	94	91	90	93	93	92	90	91	91	91	177	169	155	148	153	154	166	168	162	158	157	152	155	157	153	159	161
127	71	71	70	73	73	72	74	76	76	76	77	78	73	74	75	74	74	177	170	156	148	152	153	154	166	168	162	158	160	157	150	155	156	157
128	72	71	70	74	78	78	75	76	76	75	74	75	74	76	75	75	74	134	138	145	148	150	147	142	138	132	131	132	131	129	130	130	132	132
129	84	81	79	76	81	86	78	79	82	82	80	83	85	80	80	78	78	126	120	116	107	105	112	121	110	119	125	129	113	119	121	121	124	128
130	74	71	72	73	73	73	71	70	70	71	76	79	78	78	79	78	78	118	134	136	140	137	133	139	135	138	134	126	118	116	119	117	117	110
131	82	84	84	89	89	89	89	87	86	85	85	85	84	84	84	82	82	133	142	154	154	158	159	160	156	151	153	150	137	140	141	142	143	143
132	87	87	88	89	89	90	90	85	88	85	84	83	83	86	87	88	88	145	142	143	141	146	145	148	143	147	151	149	150	151	155	148	150	144
133	73	74	75	78	81	79	80	80	80	80	82	82	82	82	81	80	80	129	139	149	154	155	153	147	146	147	146	134	134	135	136	137	138	137
134	73	73	73	72	81	71	71	70	72	72	73	75	74	73	73	72	72	150	150	148	150	149	147	146	145	151	144	143	146	149	140	138	143	140

Sr.No.	IASBP_36 Min	IASBP_38 Min	IASBP_40 Min	IASBP_42 Min	IASBP_44 Min	IADBP_2 Min	IADBP_4 Min	IADBP_6 Min	IADBP_8 Min	IADBP_10 Min	IADBP_12 Min	IADBP_14 Min	IADBP_16 Min	IADBP_18 Min	IADBP_20 Min	IADBP_22 Min	IADBP_24 Min	IADBP_26 Min	IADBP_28 Min	IADBP_30 Min	IADBP_32 Min	IADBP_34 Min	IADBP_36 Min	IADBP_38 Min	IADBP_40 Min	IADBP_42 Min	IADBP_44 Min	MAP_2 Min	MAP_4 Min	MAP_6 Min	MAP_8 Min	MAP_10 Min	MAP_12 Min
1	147	149	146	142	148	98	99	100	110	108	99	98	94	100	98	99	91	90	89	90	89	90	88	87	84	80	88	126	137	136	151	138	127
2	140	142	138	138	140	88	82	84	82	82	82	84	85	81	81	82	84	86	86	82	84	82	82	84	85	83	82	105	102	102	101	102	100
3	134	132	129	130	128	80	84	86	88	89	86	84	84	80	80	81	83	80	77	80	83	81	80	81	81	83	78	98	102	105	101	109	106
4	122	120	119	117	120	68	71	81	78	84	81	83	88	81	85	82	76	84	77	76	79	81	84	81	79	73	81	82	86	94	91	96	94
5	135	136	138	132	134	60	64	56	74	80	82	88	9	96	100	98	92	93	86	85	83	83	81	80	76	70	72	78	77	70	92	98	100
6	118	122	118	116	118	54	58	57	60	68	60	72	70	78	75	71	74	68	66	68	70	68	72	78	70	68	70	68	70	71	74	82	79
7	131	131	130	130	132	68	67	71	71	70	76	72	76	73	76	70	70	76	76	74	72	76	70	73	70	71	72	86	87	90	91	90	94
8	132	132	135	128	131	64	68	69	71	72	70	70	71	71	73	72	72	70	76	74	72	71	74	72	71	71	70	84	86	88	90	92	90
9	119	117	120	112	116	52	56	61	68	61	68	69	72	70	72	74	70	68	70	69	74	80	79	77	80	78	78	64	70	73	79	77	80
10	132	136	132	131	138	78	74	77	78	79	74	72	68	60	58	73	76	78	74	70	71	72	70	74	70	72	74	98	95	97	98	99	94
11	28	125	125	129	123	78	76	67	68	71	68	68	78	80	81	80	78	80	76	78	77	76	74	74	75	76	74	96	97	90	87	91	87
12	146	146	136	144	148	73	59	56	55	63	61	61	62	60	62	61	60	60	62	60	61	62	60	60	59	60	63	106	90	87	85	93	96
13	131	133	134	132	133	84	83	99	78	74	78	81	79	79	81	78	80	81	81	82	78	78	80	78	81	78	81	101	101	96	94	91	94
14	158	162	161	159	162	90	89	88	90	88	86	92	85	81	85	79	81	82	83	85	86	91	90	92	91	93	94	113	110	108	110	109	108
15	119	128	131	130	128	67	58	58	55	61	60	66	58	75	54	67	66	64	64	68	64	75	69	63	70	67	68	87	90	68	77	78	92
16	136	137	142	144	146	89	87	84	79	88	89	88	86	82	81	79	83	79	80	83	80	81	84	85	86	84	81	106	106	101	99	106	106
17	158	160	156	158	160	94	93	80	78	80	81	82	81	83	80	79	80	81	83	81	89	88	92	90	91	91	90	115	112	99	93	99	100
18	122	123	122	130	134	77	82	80	81	77	78	80	80	80	83	80	81	80	76	77	74	85	81	83	81	85	85	94	100	101	100	98	78
19	123	121	120	122	119	68	60	63	68	72	68	66	70	68	72	74	70	68	70	74	72	74	71	82	81	81	79	82	79	81	86	88	85
20	148	146	144	142	143	62	61	64	65	65	69	69	69	71	70	68	69	69	67	63	63	62	62	61	60	61	60	91	96	96	99	98	102
21	140	138	141	144	145	80	83	79	82	81	82	80	79	83	77	80	81	76	76	79	85	82	79	77	79	80	82	100	101	100	102	103	102
22	140	144	142	143	139	70	68	68	63	63	65	67	68	68	65	70	72	70	71	70	72	73	73	75	75	76	78	95	93	91	86	86	87
23	131	134	136	135	134	82	78	76	74	72	73	75	75	79	76	76	76	78	75	76	82	81	78	80	80	81	86	101	95	92	85	82	86
24	144	142	146	147	144	63	62	62	61	63	62	64	63	65	65	64	66	67	61	63	62	64	62	65	62	64	61	88	87	87	89	91	90
25	140	148	144	142	149	62	49	49	53	54	53	55	64	61	57	58	55	59	58	57	61	61	61	77	72	63	64	101	74	80	81	82	83
26	153	155	160	168	157	66	59	64	65	76	70	77	76	75	74	71	72	72	71	73	69	74	70	74	77	76	75	90	82	84	90	105	94
27	153	153	152	150	150	59	55	56	56	57	76	72	72	70	68	70	70	65	69	68	68	70	71	70	70	68	68	99	92	93	94	96	107

Sr.No.	IASBP_36 Min	IASBP_38 Min	IASBP_40 Min	IASBP_42 Min	IASBP_44 Min	IADBP_2 Min	IADBP_4 Min	IADBP_6 Min	IADBP_8 Min	IADBP_10 Min	IADBP_12 Min	IADBP_14 Min	IADBP_16 Min	IADBP_18 Min	IADBP_20 Min	IADBP_22 Min	IADBP_24 Min	IADBP_26 Min	IADBP_28 Min	IADBP_30 Min	IADBP_32 Min	IADBP_34 Min	IADBP_36 Min	IADBP_38 Min	IADBP_40 Min	IADBP_42 Min	IADBP_44 Min	MAP_2 Min	MAP_4 Min	MAP_6 Min	MAP_8 Min	MAP_10 Min	MAP_12 Min
28	117	118	122	121	124	61	61	58	60	61	64	62	60	68	68	63	63	64	65	67	66	69	68	70	78	77	79	74	75	74	74	76	79
29	120	122	116	107	108	60	58	60	68	66	69	69	68	65	67	73	71	70	70	69	68	68	71	72	72	72	74	82	74	73	83	82	85
30	126	123	129	122	126	73	62	59	59	66	62	61	63	58	57	61	64	70	70	66	67	66	64	68	68	71	73	93	84	78	80	83	81
31	160	166	162	160	155	87	72	81	74	78	81	75	74	76	85	84	85	82	84	82	81	84	85	90	90	92	92	109	95	100	97	101	104
32	134	131	127	128	134	76	70	64	68	70	69	70	71	74	78	76	77	78	74	75	76	78	78	76	76	79	77	95	86	77	87	91	90
33	153	148	146	151	152	95	93	90	85	82	82	85	83	84	84	85	85	86	86	90	90	91	89	89	88	89	91	120	116	111	104	99	101
34	134	135	136	135	136	68	66	62	62	60	61	60	65	65	68	68	68	73	71	70	75	73	72	72	72	71	73	89	85	82	82	80	80
35	127	133	136	132	130	76	71	74	74	89	89	85	75	73	74	71	71	79	74	74	72	73	73	73	75	76	76	94	90	90	90	107	106
36	151	150	153	151	149	93	95	97	97	98	99	99	96	93	99	96	90	91	94	95	96	98	97	97	98	97	97	108	112	114	115	116	118
37	118	115	115	119	113	68	66	57	58	61	58	58	68	70	71	70	68	70	66	68	67	66	64	64	65	66	64	86	87	80	77	81	77
38	139	136	138	136	134	76	82	82	92	94	94	93	99	98	97	93	96	93	86	87	93	91	89	86	88	89	84	94	101	101	111	117	117
39	123	124	121	117	123	73	74	75	85	83	74	73	69	75	73	75	66	65	64	65	64	65	63	62	59	55	63	101	112	112	127	113	102
40	149	150	152	146	144	86	92	92	102	104	113	109	108	97	101	103	96	93	96	97	103	101	99	96	101	99	94	104	111	111	121	107	133
41	133	130	128	128	130	66	66	66	64	67	67	67	67	66	66	64	65	68	65	63	65	65	66	65	64	65	66	90	90	90	93	90	92
42	134	135	136	135	136	68	66	62	62	60	61	60	65	65	68	68	68	73	71	70	75	73	72	72	72	71	73	89	85	82	82	80	80
43	107	109	106	112	118	58	59	60	70	68	59	58	54	60	58	59	51	50	49	50	49	50	48	47	44	50	58	86	97	96	111	98	81
44	138	135	135	139	133	88	86	78	78	81	78	78	88	90	91	90	88	90	86	88	87	86	84	84	85	86	84	106	107	100	97	101	97
45	110	112	106	113	114	50	48	50	58	56	59	58	55	57	63	61	60	60	59	58	58	58	61	62	62	62	64	72	64	63	73	72	75
46	138	142	135	133	140	68	69	68	68	69	64	68	70	68	67	68	72	69	66	64	70	68	66	67	69	61	62	96	97	102	105	107	110
47	128	130	126	128	130	64	63	50	48	50	51	52	51	53	49	50	50	51	53	51	59	58	62	60	61	61	60	85	82	69	63	69	70
48	133	130	128	128	130	66	66	66	64	67	67	67	67	66	66	64	65	68	65	63	65	65	66	65	64	65	66	90	90	90	93	90	92
49	144	142	140	138	137	80	86	96	98	99	96	94	90	91	93	90	87	90	93	91	93	91	90	91	93	88	87	98	105	115	118	119	116
50	122	123	119	111	110	60	58	56	52	53	52	53	52	54	56	61	60	59	62	60	63	61	64	68	62	61	60	77	76	76	73	71	71
51	152	155	159	160	163	76	68	60	56	56	55	62	61	62	64	64	66	62	62	65	66	65	67	67	71	70	72	110	102	91	87	89	88
52	144	143	141	140	140	80	81	81	82	82	84	88	88	89	89	88	86	86	87	82	82	81	82	85	85	83	80	104	105	105	106	107	110
53	131	131	130	130	132	68	67	71	71	70	76	72	76	73	76	70	70	76	76	74	72	76	70	73	70	71	72	86	87	90	91	90	94
54	122	126	122	121	128	68	64	67	68	69	64	62	58	50	48	63	66	68	64	60	61	62	60	64	60	62	64	89	85	87	88	90	85

Sr.No.	IASBP_36 Min	IASBP_38 Min	IASBP_40 Min	IASBP_42 Min	IASBP_44 Min	IADBP_2 Min	IADBP_4 Min	IADBP_6 Min	IADBP_8 Min	IADBP_10 Min	IADBP_12 Min	IADBP_14 Min	IADBP_16 Min	IADBP_18 Min	IADBP_20 Min	IADBP_22 Min	IADBP_24 Min	IADBP_26 Min	IADBP_28 Min	IADBP_30 Min	IADBP_32 Min	IADBP_34 Min	IADBP_36 Min	IADBP_38 Min	IADBP_40 Min	IADBP_42 Min	IADBP_44 Min	MAP_2 Min	MAP_4 Min	MAP_6 Min	MAP_8 Min	MAP_10 Min	MAP_12 Min
55	134	132	131	127	128	70	76	86	88	89	86	84	80	81	83	80	77	80	83	81	84	81	80	81	83	77	78	88	95	105	91	109	106
56	151	144	147	145	150	94	94	96	98	97	94	91	92	96	92	93	92	95	94	91	94	97	97	96	96	95	97	104	109	109	111	111	109
57	152	155	159	160	163	76	68	60	56	56	55	62	61	62	64	64	66	62	62	65	66	65	67	67	71	70	72	110	102	91	87	89	88
58	122	120	119	117	120	68	71	81	78	84	81	83	88	81	85	82	76	84	77	76	79	81	84	81	79	73	81	82	86	94	91	96	94
59	146	146	140	140	144	75	76	75	77	77	75	74	76	77	79	80	79	80	79	80	79	79	78	77	77	76	76	99	100	99	101	102	99
60	139	137	135	133	132	75	81	91	93	94	91	89	85	86	88	85	82	85	88	86	88	86	85	86	88	83	82	93	100	110	113	114	111
61	131	133	134	132	133	84	83	99	78	74	78	81	79	79	81	78	80	81	81	82	78	78	80	78	81	78	81	101	101	96	94	91	94
62	139	137	135	133	132	75	81	91	93	94	91	89	85	86	88	85	82	85	88	86	88	86	85	86	88	83	82	93	100	110	96	114	111
63	129	127	125	123	122	65	71	81	83	84	81	79	75	76	78	75	72	75	78	76	78	76	75	71	78	73	72	83	90	100	86	104	101
64	148	152	150	151	150	93	92	92	91	90	89	89	90	85	82	78	76	72	68	71	79	81	86	88	88	91	90	121	121	119	118	116	115
65	138	140	136	138	140	74	73	60	58	60	61	62	61	63	59	60	60	61	63	61	69	68	72	70	71	71	70	95	92	79	73	79	80
66	158	160	156	158	160	94	93	80	78	80	81	82	81	83	80	79	80	81	83	81	89	88	92	90	91	91	90	115	112	99	93	99	100
67	150	151	143	146	150	94	94	94	97	97	90	91	92	92	96	92	94	95	94	91	93	97	97	97	93	96	97	104	109	107	111	111	105
68	131	131	130	130	132	68	67	71	71	70	76	72	76	73	76	70	70	76	76	74	72	76	70	73	70	71	72	86	87	90	91	90	94
69	134	135	136	135	136	68	66	62	62	60	61	60	65	65	68	68	68	73	71	70	75	73	72	72	72	71	73	89	85	82	82	80	80
70	134	132	130	128	127	70	76	86	88	89	86	89	80	81	83	80	77	80	83	81	83	81	80	81	83	78	77	88	95	105	91	109	106
71	142	148	149	147	145	81	81	81	79	82	82	82	82	81	81	79	80	79	80	78	79	78	77	78	79	79	76	105	105	105	108	105	107
72	150	151	150	152	151	92	95	97	96	98	99	96	93	98	99	95	92	90	90	94	96	96	96	97	97	98	97	108	112	114	115	116	118
73	154	152	150	148	147	90	96	106	108	109	106	104	100	101	103	100	97	100	103	101	103	101	100	101	103	98	97	108	115	125	121	129	126
74	152	155	159	160	163	76	68	60	56	56	55	62	61	62	64	64	66	62	62	65	66	65	67	67	71	70	72	110	102	91	87	89	88
75	131	133	134	132	133	84	83	99	78	74	78	81	79	79	81	78	80	81	81	82	78	78	80	78	81	78	81	101	101	96	94	91	94
76	122	123	119	111	110	60	58	56	52	53	52	53	52	54	56	61	60	59	62	60	63	61	64	68	62	61	60	77	76	76	73	71	71
77	135	133	138	133	135	68	70	66	68	69	68	68	69	68	64	62	68	69	68	64	70	68	69	61	66	61	69	92	94	93	96	97	102
78	131	133	134	132	133	84	83	99	78	74	78	81	79	79	81	78	80	81	81	82	78	78	80	78	81	78	81	101	101	96	94	91	94
79	148	150	146	148	150	84	83	70	68	70	71	72	71	73	70	69	70	71	73	71	79	78	82	80	81	81	80	105	102	86	83	83	90
80	132	138	139	137	135	71	71	71	69	72	72	72	72	71	71	69	70	69	70	68	69	68	67	68	69	69	66	95	95	95	98	95	97
81	122	120	119	117	120	68	71	81	78	84	81	83	88	81	85	82	76	84	77	76	79	81	84	81	79	73	81	82	86	94	91	96	94

Sr.No.	IASBP_36 Min	IASBP_38 Min	IASBP_40 Min	IASBP_42 Min	IASBP_44 Min	IADBP_2 Min	IADBP_4 Min	IADBP_6 Min	IADBP_8 Min	IADBP_10 Min	IADBP_12 Min	IADBP_14 Min	IADBP_16 Min	IADBP_18 Min	IADBP_20 Min	IADBP_22 Min	IADBP_24 Min	IADBP_26 Min	IADBP_28 Min	IADBP_30 Min	IADBP_32 Min	IADBP_34 Min	IADBP_36 Min	IADBP_38 Min	IADBP_40 Min	IADBP_42 Min	IADBP_44 Min	MAP_2 Min	MAP_4 Min	MAP_6 Min	MAP_8 Min	MAP_10 Min	MAP_12 Min
82	153	153	152	150	150	59	55	56	56	57	76	72	72	70	68	70	70	65	69	68	68	70	71	70	70	68	68	99	92	93	94	96	107
83	127	129	126	122	128	78	79	80	90	88	79	78	74	80	78	79	71	70	69	70	69	70	68	67	64	60	68	106	117	116	131	118	107
84	140	142	138	138	140	88	82	84	82	82	82	84	85	81	81	82	84	86	86	82	84	82	82	84	85	83	82	105	102	102	101	102	100
85	132	132	135	128	131	64	68	69	71	72	70	70	71	71	73	72	72	70	76	74	72	71	74	72	71	71	70	84	86	88	90	92	90
86	148	150	146	148	150	84	83	70	68	70	71	72	71	73	70	69	70	71	73	71	79	78	82	80	81	81	80	105	102	89	83	89	90
87	152	155	159	160	163	76	68	60	56	56	55	62	61	62	64	64	66	62	62	65	66	65	67	67	71	70	72	110	102	91	87	89	88
88	131	131	130	130	132	68	67	71	71	70	76	72	76	73	76	70	70	76	76	74	72	76	70	73	70	71	72	86	87	90	91	90	94
89	131	128	133	132	130	76	71	75	74	74	89	84	75	73	71	80	74	73	74	72	73	73	72	72	73	76	76	94	90	90	90	90	106
90	122	123	119	111	110	60	58	56	52	53	52	53	52	54	56	61	60	59	62	60	63	61	64	68	62	61	60	77	76	76	73	71	71
91	129	127	125	123	122	65	71	81	83	84	81	79	75	76	78	75	72	75	78	76	78	76	75	71	78	73	72	83	90	100	86	104	101
92	122	120	119	117	120	68	71	81	78	84	81	83	88	81	85	82	76	84	77	76	79	81	84	81	79	73	81	82	86	94	91	96	94
93	152	155	159	160	163	76	68	60	56	56	55	62	61	62	64	64	66	62	62	65	66	65	67	67	71	70	72	110	102	91	87	89	88
94	134	135	136	135	136	68	66	62	62	60	61	60	65	65	68	68	68	73	71	70	75	73	72	72	72	71	73	89	85	82	82	80	80
95	150	151	143	146	150	94	94	94	97	97	90	91	92	92	96	92	94	95	94	91	93	97	97	97	93	96	97	104	109	107	111	111	105
96	152	156	152	151	158	98	94	97	98	99	94	92	88	80	78	93	96	88	94	90	91	92	90	94	90	92	94	119	115	117	118	120	115
97	131	133	134	132	133	84	83	99	78	74	78	81	79	79	81	78	80	81	81	82	78	78	80	78	81	78	81	101	101	96	94	91	94
98	144	140	138	136	132	74	73	72	73	64	66	68	70	88	100	98	96	100	99	100	99	99	88	86	90	82	83	92	86	86	86	77	83
99	132	136	132	13	138	78	74	77	78	79	74	72	68	60	58	73	76	78	74	70	71	722	70	74	70	72	74	99	95	97	98	100	95
100	152	155	159	160	163	76	68	60	56	56	55	62	61	62	64	64	66	62	62	65	66	65	67	67	71	70	72	110	102	91	87	89	88
101	122	123	119	111	110	60	58	56	52	53	52	53	52	54	56	61	60	59	62	60	63	61	64	68	62	61	60	77	76	76	73	71	71
102	139	135	136	137	140	79	80	79	78	77	74	74	72	81	71	72	73	73	66	64	72	71	68	70	71	71	73	106	107	105	105	105	101
103	133	130	128	128	130	66	66	66	64	67	67	67	67	66	66	64	65	68	65	63	65	65	66	65	64	65	66	90	90	90	93	90	92
104	153	151	156	157	155	73	72	76	82	80	82	77	73	72	72	70	71	71	71	80	82	81	79	76	78	81	81	100	100	105	109	106	107
105	128	125	125	129	123	78	76	67	68	71	68	68	76	81	81	80	78	80	76	78	77	76	74	74	75	76	74	96	97	90	87	91	87
106	108	105	105	109	103	58	56	47	48	51	48	48	56	60	61	60	58	60	56	58	57	56	54	54	55	56	54	76	77	70	67	71	67
107	142	146	142	141	148	88	84	87	88	89	84	82	78	70	68	83	86	88	84	80	81	82	80	84	80	82	84	109	105	107	108	110	105
108	145	143	148	143	145	78	80	76	78	79	78	78	79	78	74	72	78	79	78	74	80	78	79	71	76	71	79	102	104	103	106	107	112

Sr.No.	IASBP_36 Min	IASBP_38 Min	IASBP_40 Min	IASBP_42 Min	IASBP_44 Min	IADBP_2 Min	IADBP_4 Min	IADBP_6 Min	IADBP_8 Min	IADBP_10 Min	IADBP_12 Min	IADBP_14 Min	IADBP_16 Min	IADBP_18 Min	IADBP_20 Min	IADBP_22 Min	IADBP_24 Min	IADBP_26 Min	IADBP_28 Min	IADBP_30 Min	IADBP_32 Min	IADBP_34 Min	IADBP_36 Min	IADBP_38 Min	IADBP_40 Min	IADBP_42 Min	IADBP_44 Min	MAP_2 Min	MAP_4 Min	MAP_6 Min	MAP_8 Min	MAP_10 Min	MAP_12 Min
109	139	137	135	133	132	75	81	91	93	94	91	89	85	86	88	85	82	85	88	86	88	86	85	86	88	83	82	93	100	110	96	114	111
110	137	139	136	132	138	88	89	90	100	98	89	88	84	90	88	89	81	80	79	80	79	80	78	77	74	70	78	116	127	126	141	128	117
111	118	122	126	120	121	69	85	88	89	87	85	83	84	88	84	77	76	71	70	75	72	74	76	78	77	78	78	82	99	105	104	104	101
112	148	152	145	143	150	78	79	78	78	79	74	78	80	78	77	78	82	79	76	74	80	78	76	77	79	71	72	106	107	112	115	117	120
113	152	155	159	160	163	76	68	60	56	56	55	62	61	62	64	64	66	62	62	65	66	65	67	67	71	70	72	110	102	91	87	89	88
114	131	128	133	132	130	76	71	75	74	74	89	84	75	73	71	80	74	73	74	72	73	73	72	72	73	76	76	94	90	90	90	90	106
115	139	137	135	132	132	75	81	80	91	90	93	94	84	88	88	85	82	84	88	86	86	86	85	86	88	82	82	93	100	100	110	110	113
116	122	128	129	127	125	61	61	61	59	62	62	62	62	61	61	59	60	59	60	58	59	58	57	58	59	59	66	85	85	85	88	85	87
117	117	118	108	109	110	58	57	47	49	50	48	48	48	60	61	57	58	58	60	58	58	57	56	54	54	56	56	76	78	70	68	71	67
118	122	126	122	121	128	68	64	67	68	69	67	62	58	50	48	63	66	68	64	60	61	62	60	64	60	62	64	88	85	87	88	89	84
119	132	127	126	130	128	64	64	62	64	64	68	70	68	68	72	71	68	68	62	64	70	67	69	70	69	69	68	85	85	82	85	85	84
120	153	155	151	153	155	89	88	75	73	75	76	77	76	78	75	74	75	76	78	76	84	83	87	85	86	86	85	110	107	94	88	94	95
121	152	156	152	151	158	98	94	97	98	99	94	92	88	80	78	93	96	98	94	90	91	92	90	94	90	92	94	119	115	117	118	120	115
122	136	134	132	131	135	70	69	64	66	84	70	80	88	96	98	100	101	99	98	99	91	88	82	86	83	83	81	88	82	77	83	96	88
123	139	137	135	133	132	75	81	91	93	94	91	89	85	86	88	85	82	85	88	86	88	86	85	86	88	83	82	93	100	110	96	114	111
124	152	155	159	160	163	76	68	60	56	56	55	62	61	62	64	64	66	62	62	65	66	65	67	67	71	70	72	110	102	91	87	89	88
125	147	153	156	151	150	92	97	97	98	97	96	99	92	92	93	91	91	93	92	93	93	95	96	94	94	92	92	109	112	112	113	113	112
126	163	168	166	158	155	76	67	59	56	55	62	61	62	64	62	63	65	65	68	71	69	72	71	70	74	75	110	110	101	91	87	88	93
127	152	155	159	160	163	76	68	60	56	56	55	62	61	62	64	64	66	62	62	65	66	65	67	67	71	70	72	110	102	91	87	89	88
128	134	132	129	130	128	80	83	86	88	90	87	84	84	80	80	82	82	81	77	80	83	82	80	80	81	83	78	98	102	105	101	109	106
129	131	135	129	132	130	91	90	84	81	79	80	80	75	78	79	83	75	81	80	78	82	82	79	80	82	82	82	103	101	95	90	89	91
130	118	122	126	120	121	69	85	88	89	87	85	83	84	88	84	77	76	71	70	75	72	74	76	78	77	78	78	82	99	105	104	104	101
131	145	141	140	137	138	80	84	96	95	98	98	99	96	90	91	93	88	90	93	91	93	91	90	91	93	87	88	98	105	115	115	118	118
132	147	153	156	151	150	92	97	97	98	97	96	99	92	92	93	91	91	93	92	93	93	95	96	94	94	92	92	109	112	112	113	113	112
133	139	137	135	133	132	75	81	91	93	94	91	89	85	86	88	85	82	85	88	86	88	86	85	86	88	83	82	93	100	110	96	114	111
134	139	135	136	137	140	79	80	79	78	77	74	74	72	81	71	72	73	73	66	64	72	71	68	70	71	71	73	106	107	105	105	105	101

Sr.No.	MAP_14 Min	MAP_16 Min	MAP_18 Min	MAP_20 Min	MAP_22 Min	MAP_24 Min	MAP_26 Min	MAP_28 Min	MAP_30 Min	MAP_32 Min	MAP_34 Min	MAP_36 Min	MAP_38 Min	MAP_40 Min	MAP_42 Min	MAP_44 Min	Sp02_2 Min	Sp02_4 Min	Sp02_6 Min	Sp02_8 Min	Sp02_10 Min	Sp02_12 Min	Sp02_14 Min	Sp02_16 Min	Sp02_18 Min	Sp02_20 Min	Sp02_22 Min	Sp02_24 Min	Sp02_26 Min	Sp02_28 Min	Sp02_30 Min	Sp02_32 Min	Sp02_34 Min	Sp02_36 Min
1	125	121	124	122	121	115	111	109	110	108	110	107	108	104	100	108	98	98	98	98	98	98	99	98	99	99	98	99	99	98	97	97	97	97
2	102	101	99	101	102	102	102	103	102	102	99	102	103	102	101	102	100	100	100	100	100	100	100	100	100	100	100	100	100	100	97	99	99
3	103	102	97	97	98	99	96	94	96	98	98	98	98	97	98	95	97	98	98	98	98	97	97	97	96	97	98	98	97	97	97	98	98	97
4	97	101	96	98	95	92	96	92	90	93	95	96	94	91	87	94	100	100	98	99	99	100	100	99	98	99	100	100	100	99	99	100	100	100
5	106	109	113	117	117	110	108	102	102	99	99	99	98	96	90	92	98	98	98	97	98	97	97	97	98	98	98	98	98	98	95	97	96	98
6	89	91	100	98	94	92	86	83	84	85	82	87	92	86	84	86	96	97	97	97	96	98	98	97	99	99	97	97	98	97	98	97	96	97
7	91	93	92	94	90	94	94	93	91	92	93	90	92	90	91	92	100	100	100	100	99	97	97	96	98	99	99	97	99	97	97	98	100	100
8	90	91	90	92	92	92	90	93	91	91	92	93	92	92	90	90	97	96	97	98	98	100	100	100	100	99	98	96	98	100	100	99	99	99
9	82	85	83	84	86	82	80	84	82	88	92	92	90	93	89	90	99	98	99	97	97	97	98	99	98	97	97	97	98	98	99	99	98	97
10	90	85	78	78	95	97	98	94	90	91	91	90	94	90	91	95	95	96	96	97	97	97	99	98	96	95	96	97	97	97	98	98	98	98
11	78	96	99	100	101	101	102	94	98	99	97	94	94	94	97	93	97	95	96	96	96	96	96	97	97	98	97	98	97	98	97	97	97	98
12	95	94	93	93	94	94	92	91	88	93	91	92	92	87	90	93	93	92	93	92	91	92	92	92	92	91	93	93	92	93	93	92	92	91
13	97	96	97	98	95	97	98	99	99	97	96	97	96	99	96	98	100	98		97	98	98	98	100	100	96	98	98	97	97	98	99	99	97
14	114	108	103	107	103	104	105	106	108	109	113	113	115	114	115	117	99	98	100	100	98	99	100	100	100	97	97	98	98	100	100	99	100	100
15	84	90	89	90	88	87	90	91	88	82	89	87	113	100	88	88	96	96	95	96	96	96	96	96	96	96	96	96	96	96	96	96	96	96
16	107	105	102	103	100	101	99	100	102	100	101	101	102	105	104	103	98	98	99	99	99	98	98	98	97	97	100	100	100	99	99	98	99	99
17	101	101	103	103	102	103	104	105	104	110	110	114	113	112	113	113	96	95	95	95	96	96	95	95	96	97	97	97	98	96	97	97	96	96
18	101	100	99	101	98	100	102	95	97	98	95	99	101	101	104	104	100	97	97	95	95	100	100	100	96	98	99	99	99	100	100	99	100	97
19	83	85	83	87	90	86	84	86	90	89	91	89	96	94	95	92	97	97	98	98	98	98	99	99	97	99	99	99	99	99	100	99	99	98
20	101	100	100	98	98	100	99	99	95	93	91	91	89	88	88	88	99	99	98	98	98	98	97	97	98	97	99	99	98	98	99	99	98	98
21	101	99	101	97	98	101	97	96	100	104	102	99	97	100	101	103	100	98	97	97	97	99	99	100	98	100	100	100	98	98	100	100	99	98
22	89	90	91	88	93	93	93	94	93	94	96	95	98	97	98	98	99	99	98	98	97	97	97	98	98	98	99	100	100	100	99	99	98	98
23	90	90	93	92	91	90	93	92	92	98	98	95	99	99	99	102	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
24	92	91	90	91	89	92	93	89	88	87	88	90	91	90	92	89	100	99	99	100	100	100	99	99	98	98	96	96	98	98	99	99	100	100
25	85	92	94	91	88	86	97	86	91	94	85	88	100	96	90	92	100	100	100	100	100	100	98	98	98	98	98	98	98	98	98	98	98	98
26	108	105	105	99	98	95	93	91	96	96	100	97	98	100	103	98	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
27	106	105	103	99	102	100	96	98	97	95	100	101	100	100	97	97	100	100	100	100	100	100	100	100	100	100	99	98	98	100	100	100	99

Sr.No.	MAP_14 Min	MAP_16 Min	MAP_18 Min	MAP_20 Min	MAP_22 Min	MAP_24 Min	MAP_26 Min	MAP_28 Min	MAP_30 Min	MAP_32 Min	MAP_34 Min	MAP_36 Min	MAP_38 Min	MAP_40 Min	MAP_42 Min	MAP_44 Min	Sp02_2 Min	Sp02_4 Min	Sp02_6 Min	Sp02_8 Min	Sp02_10 Min	Sp02_12 Min	Sp02_14 Min	Sp02_16 Min	Sp02_18 Min	Sp02_20 Min	Sp02_22 Min	Sp02_24 Min	Sp02_26 Min	Sp02_28 Min	Sp02_30 Min	Sp02_32 Min	Sp02_34 Min	Sp02_36 Min
28	79	75	84	85	79	76	79	80	82	82	86	84	91	93	92	94	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
29	85	85	82	84	88	85	87	86	83	83	84	87	87	87	89	91	95	95	95	95	95	96	96	96	96	96	96	96	96	96	96	96	96	96
30	82	83	79	79	81	81	84	85	85	87	88	85	86	88	88	91	97	97	97	97	97	97	97	97	97	97	97	97	99	99	100	100	100	100
31	98	96	101	109	109	111	108	110	107	107	109	110	115	114	115	113	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
32	90	90	91	95	95	95	95	91	93	94	97	92	93	93	97	95	99	99	99	99	99	99	99	97	96	97	97	96	96	96	96	96	96	98
33	105	103	103	103	105	105	107	107	110	110	111	110	109	107	109	111	100	99	99	99	100	100	100	98	99	98	98	99	100	100	99	100	99	99
34	80	84	85	88	89	89	93	92	92	96	94	93	93	94	92	94	99	99	98	97	97	98	97	98	98	99	99	98	97	96	97	96	97	98
35	104	91	93	89	93	88	95	92	93	92	92	91	93	95	95	94	98	98	98	98	97	97	99	99	98	99	99	99	100	100	100	99	100	100
36	118	115	112	116	111	107	108	112	112	113	116	115	115	116	115	114	96	97	96	97	96	96	96	96	97	98	98	98	98	96	96	96	96	98
37	68	86	89	90	91	91	92	84	88	89	87	84	84	84	87	83	98	98	99	97	98	98	99	97	99	98	97	96	97	98	98	97	99	98
38	110	113	115	114	11	112	110	102	104	109	108	104	102	102	101	101	99	100	100	100	100	100	100	98	98	98	98	100	100	100	99	99	100	98
39	101	97	99	97	95	90	86	84	86	83	85	82	73	79	75	83	98	97	99	99	99	100	100	99	99	100	99	99	100	98	98	99	98	100
40	129	126	117	121	122	112	110	112	114	119	118	114	114	118	111	111	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98
41	91	92	91	90	88	89	88	89	87	88	85	84	86	87	87	84	99	98	97	98	98	99	100	100	99	99	98	100	98	99	99	98	99	99
42	80	84	85	88	89	89	93	92	92	96	94	93	93	94	92	94	99	99	98	97	97	98	97	98	98	99	99	98	97	96	97	96	97	98
43	85	81	84	82	81	75	71	69	70	68	70	67	68	64	70	78	98	99	97	97	98	98	99	99	98	99	99	100	100	100	100	98	99	98
44	88	106	109	110	111	111	112	104	108	109	107	104	104	104	107	103	97	97	98	98	98	98	99	99	98	96	96	96	97	97	98	98	97	96
45	75	72	74	78	76	77	76	73	73	73	74	77	77	77	79	81	99	99	97	99	96	97	97	99	97	97	96	97	97	99	99	96	97	97
46	107	106	100	97	97	102	97	93	91	92	92	90	92	91	85	88	96	96	96	96	96	96	96	95	95	95	97	97	96	97	97	98	98	97
47	71	71	73	73	72	73	74	75	74	80	80	84	83	82	83	83	100	100	100	100	99	100	100	99	99	100	99	99	100	100	100	100	99	100
48	91	92	91	90	88	89	88	89	87	88	85	84	86	87	87	84	99	98	97	98	98	99	100	100	99	99	98	100	98	99	99	98	99	99
49	112	110	111	112	106	104	106	109	108	108	108	108	108	108	105	105	99	97	97	99	97	97	99	97	97	97	97	99	97	99	97	98	98	100
50	72	71	72	76	81	80	80	82	79	81	80	83	86	81	78	77	100	100	99	99	99	98	98	97	99	99	100	100	100	100	100	100	99	100
51	93	96	97	97	95	95	94	89	95	95	96	96	98	100	99	102	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	100	100
52	113	112	113	115	113	109	110	110	106	105	104	103	104	104	102	100	97	97	98	98	98	96	96	96	98	98	98	98	98	98	98	98	98	98
53	91	93	92	94	90	94	94	93	91	92	93	90	92	90	91	92	100	100	100	100	99	97	97	96	98	99	99	97	99	97	97	98	100	100
54	84	79	65	63	85	86	88	85	81	82	82	81	85	81	82	85	98	99	99	100	100	100	100	100	99	99	98	99	100	100	99	99	100	100

Sr.No.	MAP_14 Min	MAP_16 Min	MAP_18 Min	MAP_20 Min	MAP_22 Min	MAP_24 Min	MAP_26 Min	MAP_28 Min	MAP_30 Min	MAP_32 Min	MAP_34 Min	MAP_36 Min	MAP_38 Min	MAP_40 Min	MAP_42 Min	MAP_44 Min	Sp02_2 Min	Sp02_4 Min	Sp02_6 Min	Sp02_8 Min	Sp02_10 Min	Sp02_12 Min	Sp02_14 Min	Sp02_16 Min	Sp02_18 Min	Sp02_20 Min	Sp02_22 Min	Sp02_24 Min	Sp02_26 Min	Sp02_28 Min	Sp02_30 Min	Sp02_32 Min	Sp02_34 Min	Sp02_36 Min
55	102	100	101	102	96	94	96	99	98	98	98	98	98	98	95	95	99	100	100	99	100	100	98	98	99	99	100	100	100	98	99	98	98	100
56	105	106	111	108	110	109	112	112	108	112	115	115	110	113	112	115	96	97	97	98	98	98	97	96	96	98	98	98	97	98	98	99	99	98
57	93	96	97	97	95	95	94	89	95	95	96	96	98	100	99	102	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	100	100
58	97	101	96	98	95	92	96	92	90	93	95	96	94	91	87	94	100	100	98	99	99	100	100	99	98	99	100	100	100	99	99	100	100	100
59	99	100	101	104	106	104	106	105	106	100	105	105	101	103	102	97	99	97	97	97	97	98	97	98	98	97	97	97	96	96	97	97	97	97
60	107	105	106	107	101	99	101	104	103	102	102	102	102	102	100	100	99	100	100	100	99	98	97	98	98	99	100	100	100	100	98	97	99	98
61	97	96	97	98	95	97	98	99	99	97	96	97	96	99	96	98	100	98		97	98	98	98	100	100	96	98	98	97	97	98	99	99	97
62	107	105	106	107	101	99	101	104	103	103	103	103	103	103	100	100	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
63	97	95	96	97	91	89	91	95	93	93	93	93	93	93	90	90	99	100	100	100	100	100	100	100	99	99	99	99	99	99	100	100	100	100
64	114	116	108	105	101	97	93	91	94	100	102	107	109	109	111	110	100	100	99	99	100	99	98	99	99	97	97	98	97	99	100	100	100	100
65	81	81	83	83	82	83	84	85	84	90	90	94	93	92	93	93	97	97	98	98	99	99	98	98	97	98	98	98	99	99	97	97	98	99
66	101	101	103	103	102	103	104	105	104	110	110	114	113	112	113	113	99	100	100	100	100	99	99	99	100	100	99	98	98	99	100	100	100	99
67	105	106	106	111	108	110	112	112	108	112	115	115	115	108	113	115	96	96	98	98	98	96	96	96	97	97	98	98	98	96	96	98	98	97
68	91	93	92	94	90	94	94	93	91	92	93	90	92	90	91	92	100	100	100	100	99	97	97	96	98	99	99	97	99	97	97	98	100	100
69	80	84	85	88	89	89	93	92	92	96	94	93	93	94	92	94	99	99	98	97	97	98	97	98	98	99	99	98	97	96	97	96	97	98
70	102	100	101	102	96	94	96	99	98	98	98	98	98	98	95	95	98	99	99	99	97	97	98	98	98	99	98	97	97	98	99	97	96	99
71	106	107	108	108	107	107	106	107	108	103	100	99	101	102	102	99	99	98	97	96	96	97	97	96	97	98	98	99	99	100	100	100	99	98
72	114	112	115	116	110	108	107	108	112	112	113	115	115	115	116	115	100	98	98	98	98	100	100	100	100	100	98	98	98	100	100	100	99	98
73	122	120	121	122	116	114	116	119	118	118	118	118	118	118	115	115	96	96	96	97	97	96	97	96	96	97	98	98	98	97	97	98	98	97
74	93	96	97	97	95	95	94	89	95	95	96	96	98	100	99	102	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	100	100
75	97	96	97	98	95	97	98	99	99	97	96	97	96	99	96	98	100	98		97	98	98	98	100	100	96	98	98	97	97	98	99	99	97
76	72	71	72	76	81	80	80	82	79	81	80	83	86	81	78	77	100	100	99	99	99	98	98	97	99	99	100	100	100	100	100	100	99	100
77	105	107	102	98	94	96	97	95	91	94	92	91	85	90	85	91	100	100	100	100	99	99	100	100	100	100	99	100	100	99	99	100	100	100
78	97	96	97	98	95	97	98	99	99	97	96	97	96	99	96	98	100	98		97	98	98	98	100	100	96	98	98	97	97	98	99	99	97
79	91	91	93	93	92	93	94	95	94	100	100	104	103	102	103	103	97	97	96	97	95	96	96	96	97	98	99	97	97	98	99	97	97	97
80	96	97	96	95	93	94	93	94	92	93	90	89	91	92	92	89	97	97	99	98	99	97	97	99	98	98	97	97	96	97	98	98	99	98
81	97	101	96	98	95	92	96	92	90	93	95	96	94	91	87	94	100	100	98	99	99	100	100	99	98	99	100	100	100	99	99	100	100	100

Sr.No.	MAP_14 Min	MAP_16 Min	MAP_18 Min	MAP_20 Min	MAP_22 Min	MAP_24 Min	MAP_26 Min	MAP_28 Min	MAP_30 Min	MAP_32 Min	MAP_34 Min	MAP_36 Min	MAP_38 Min	MAP_40 Min	MAP_42 Min	MAP_44 Min	Sp02_2 Min	Sp02_4 Min	Sp02_6 Min	Sp02_8 Min	Sp02_10 Min	Sp02_12 Min	Sp02_14 Min	Sp02_16 Min	Sp02_18 Min	Sp02_20 Min	Sp02_22 Min	Sp02_24 Min	Sp02_26 Min	Sp02_28 Min	Sp02_30 Min	Sp02_32 Min	Sp02_34 Min	Sp02_36 Min
82	106	105	103	99	102	100	96	98	97	95	100	101	100	100	97	97	100	100	100	100	100	100	100	100	100	100	100	99	98	98	100	100	100	99
83	105	101	104	102	101	95	91	89	90	88	90	87	88	84	80	88	98	100	100	99	100	100	99	99	97	98	97	97	97	97	99	97	98	97
84	102	101	99	101	102	102	102	103	102	102	99	102	103	102	101	102	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	97	99	99
85	90	91	90	92	92	92	90	93	91	91	92	93	92	92	90	90	97	96	97	98	98	100	100	100	100	99	98	96	98	100	100	99	99	99
86	91	91	93	93	92	93	94	95	94	100	100	104	103	102	103	103	99	98	99	99	99	98	97	97	97	99	98	99	98	99	99	99	97	99
87	93	96	97	97	95	95	94	89	95	95	96	96	98	100	99	102	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	100	100
88	91	93	92	94	90	94	94	93	91	92	93	90	92	90	91	92	100	100	100	100	99	97	97	96	98	99	99	97	99	97	97	98	100	100
89	106	104	91	93	88	96	92	91	93	92	92	92	92	93	95	94	99	99	100	100	99	98	98	98	99	99	100	100	100	99	99	100	100	100
90	72	71	72	76	81	80	80	82	79	81	80	83	86	81	78	77	100	100	99	99	99	98	98	97	99	99	100	100	100	100	100	100	99	100
91	97	95	96	97	91	89	91	95	93	93	93	93	93	93	90	90	99	100	100	100	100	100	100	100	100	99	99	99	99	99	99	100	100	100
92	97	101	96	98	95	92	96	92	90	93	95	96	94	91	87	94	100	100	98	99	99	100	100	99	98	99	100	100	100	99	99	100	100	100
93	93	96	97	97	95	95	94	89	95	95	96	96	98	100	99	102	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	100	100
94	80	84	85	88	89	89	93	92	92	96	94	93	93	94	92	94	99	99	98	97	97	98	97	98	98	99	99	98	97	96	97	96	97	98
95	105	106	106	111	108	110	112	112	108	112	115	115	115	108	113	115	96	96	98	98	98	96	96	96	97	97	98	98	98	96	96	98	98	97
96	114	109	95	93	115	116	118	115	111	112	112	111	115	111	112	115	100	100	100	99	97	97	98	98	98	98	97	99	99	100	100	97	97	99
97	97	96	97	98	95	97	98	99	99	97	96	97	96	99	96	98	100	98		97	98	98	98	100	100	96	98	98	97	97	98	99	99	97
98	100	88	106	117	117	117	121	121	123	120	117	106	106	106	100	99	98	98	98	98	100	100	100	99	99	99	99	100	99	99	100	100	100	99
99	94	89	75	73	95	96	98	95	91	92	92	91	95	91	92	95	97	96	97	98	97	97	98	98	99	99	98	97	97	98	99	100	100	99
100	93	96	97	97	95	95	94	89	95	95	96	96	98	100	99	102	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	100	100
101	72	71	72	76	81	80	80	82	79	81	80	83	86	81	78	77	100	100	99	99	99	98	98	97	99	99	100	100	100	100	100	100	99	100
102	101	100	104	99	99	100	98	91	89	99	94	92	95	95	96	98	100	100	99	99	99	99	99	98	99	99	100	100	100	99	100	100	100	100
103	91	92	91	90	88	89	88	89	87	88	85	84	86	87	87	84	99	98	97	98	98	99	100	100	99	99	98	100	98	99	99	98	99	99
104	103	100	98	100	99	99	100	98	103	104	105	104	101	104	106	106	96	97	98	98	97	97	96	96	95	96	96	97	96	96	96	96	95	96
105	78	96	99	100	101	101	102	94	98	99	97	94	94	94	97	93	99	98	98	98	100	100	100	100	100	100	100	100	100	100	100	98	98	98
106	58	76	79	80	81	81	82	74	78	79	77	74	74	74	77	73	100	99	100	100	97	97	98	98	97	99	99	98	99	99	100	97	99	100
107	4	99	85	83	105	106	108	105	101	102	102	101	105	101	102	105	97	97	97	96	97	97	96	97	97	96	96	96	97	97	97	96	97	98
108	115	117	112	108	104	106	107	105	101	104	102	101	95	100	95	101	100	100	100	100	100	100	100	100	100	100	100	100	99	99	99	100	100	100	99

Sr.No.	MAP_14 Min	MAP_16 Min	MAP_18 Min	MAP_20 Min	MAP_22 Min	MAP_24 Min	MAP_26 Min	MAP_28 Min	MAP_30 Min	MAP_32 Min	MAP_34 Min	MAP_36 Min	MAP_38 Min	MAP_40 Min	MAP_42 Min	MAP_44 Min	Sp02_2 Min	Sp02_4 Min	Sp02_6 Min	Sp02_8 Min	Sp02_10 Min	Sp02_12 Min	Sp02_14 Min	Sp02_16 Min	Sp02_18 Min	Sp02_20 Min	Sp02_22 Min	Sp02_24 Min	Sp02_26 Min	Sp02_28 Min	Sp02_30 Min	Sp02_32 Min	Sp02_34 Min	Sp02_36 Min
109	107	105	106	107	101	99	101	104	103	103	103	103	103	103	100	100	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
110	115	111	114	112	111	105	101	99	100	98	100	97	98	94	90	98	98	99	98	98	98	98	99	99	99	99	97	97	98	97	98	97	98	98
111	102	100	105	101	93	91	89	90	91	91	89	90	93	93	92	92	100	100	99	99	98	98	98	98	99	98	100	100	100	100	98	100	99	100
112	117	116	110	107	107	112	107	103	101	102	102	100	102	101	95	98	95	96	96	94	94	95	95	97	97	96	96	97	96	96	97	95	96	95
113	93	96	97	97	95	95	94	89	95	95	96	96	98	100	99	102	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	100	100
114	106	104	91	93	88	96	92	91	93	92	92	92	92	93	95	94	99	99	100	100	99	98	98	98	99	99	100	100	100	99	99	100	100	100
115	114	105	107	107	101	99	101	104	103	102	102	102	102	102	100	100	99	99	99	98	98	98	98	100	100	100	100	98	98	100	100	100	100	99
116	86	87	86	85	83	84	83	84	82	83	80	79	81	82	82	79	97	97	99	99	100	100	100	99	100	100	98	98	100	99	98	98	99	99
117	67	58	79	80	78	81	76	81	75	78	79	76	75	74	74	74	100	99	99	100	100	100	100	100	100	100	100	99	98	98	98	98	98	98
118	80	75	68	68	85	87	88	84	80	81	81	80	84	80	81	85	100	99	98	97	98	99	98	97	97	95	95	96	97	97	96	95	97	96
119	86	79	81	85	87	85	87	82	85	90	88	88	89	88	89	88	100	100	100	100	100	100	100	99	99	98	98	98	98	98	98	100	100	100
120	96	96	98	98	97	98	99	100	99	105	105	109	108	107	108	108	97	97	97	96	97	98	98	97	98	97	98	97	96	97	98	97	98	98
121	114	109	95	93	115	116	118	115	111	112	112	111	115	111	112	115	96	95	95	95	96	97	97	96	96	95	96	97	97	96	96	95	96	96
122	98	106	113	117	121	123	120	117	117	109	106	100	102	99	99	99	98	98	97	97	97	97	96	97	97	98	98	97	97	99	99	97	98	98
123	107	105	106	107	101	99	101	104	103	103	103	103	103	103	100	100	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
124	93	96	97	97	95	95	94	89	95	95	96	96	98	100	99	102	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	100	100	100
125	115	110	110	112	112	111	112	113	111	112	111	113	114	115	112	111	100	100	100	100	100	100	100	99	98	97	97	99	100	100	100	100	100	99
126	96	97	97	95	94	93	95	96	96	100	100	102	103	102	102	102	99	100	99	99	99	100	100	100	99	100	100	100	99	100	100	100	100	100
127	93	96	97	97	95	95	94	89	95	95	96	96	98	100	99	102	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	100	100	100
128	103	102	97	97	98	99	96	94	96	98	98	98	98	97	98	95	96	97	97	97	96	98	97	98	98	97	97	98	97	98	98	97	97	98
129	94	90	92	94	98	89	94	94	94	96	97	96	98	98	99	98	100	100	100	99	99	99	99	99	99	99	99	99	100	100	100	99	99	100
130	102	100	105	101	93	91	89	90	91	91	89	90	93	93	92	92	100	100	99	99	98	98	98	98	99	98	100	100	100	100	98	100	99	100
131	119	116	110	111	112	106	106	109	108	108	108	108	108	108	105	105	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98	98
132	115	110	110	112	112	111	112	113	111	112	111	113	114	115	112	111	100	100	100	100	100	100	100	99	98	97	97	99	100	100	100	100	100	99
133	107	105	106	107	101	99	101	104	103	103	103	103	103	103	100	100	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
134	101	100	104	99	99	100	98	91	89	99	94	92	95	95	96	98	100	100	99	99	99	99	99	98	99	99	100	100	100	99	100	100	100	100

Sr.No.	Sp02_38 Min	Sp02_40 Min	Sp02_42 Min	Sp02_44 Min	Infusion Rate_2 Min	Infusion Rate_4 Min	Infusion Rate_6 Min	Infusion Rate_8 Min	Infusion Rate_10 Min	Infusion Rate_12 Min	Infusion Rate_14 Min	Infusion Rate_16 Min	Infusion Rate_18 Min	Infusion Rate_20 Min	Infusion Rate_22 Min	Infusion Rate_24 Min	Infusion Rate_26 Min	Infusion Rate_28 Min	Infusion Rate_30 Min	Infusion Rate_32 Min	Infusion Rate_34 Min	Infusion Rate_36 Min	Infusion Rate_38 Min	Infusion Rate_40 Min	Infusion Rate_42 Min	Infusion Rate_44 Min	Rescue Bolus_2 Min	Rescue Bolus_4 Min	Rescue Bolus_6 Min	Rescue Bolus_8 Min	Rescue Bolus_10 Min	Rescue Bolus_12 Min
1	98	98	99	99	60	60	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	30	30	30	30	30	30	30						
2	99	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
3	97	97	98	99	60	60	60	60	60	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30						
4	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
5	98	98	98	97	60	69	72	72	72	72	72	72	72	72	72	36	36	36	36	36	36	36	36	36	36	36			4			
6	98	98	98	98	60	72	72	72	72	72	72	72	72	36	36	36	36	36	36	36	36	36	36	36	36	36		4				
7	99	100	99	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
8	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
9	96	98	99	99	99	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72		4				
10	98	99	98	96	60	60	60	60	60	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72						
11	98	98	98	98	60	60	60	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72						
12	91	93	93	93	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
13	96	97	96	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
14	99	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
15	96	98	98	97	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72			4	4		
16	98	97	97	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
17	96	96	97	98	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72				10		
18	97	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
19	98	98	99	99	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
20	97	99	99	99	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
21	98	98	98	99	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
22	98	99	99	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
23	100	100	100	100	60	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72					4	
24	100	100	99	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
25	96	98	98	97	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72				10	10	
26	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
27	99	99	98	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						

Sr.No.	Sp02_38 Min	Sp02_40 Min	Sp02_42 Min	Sp02_44 Min	Infusion Rate_2 Min	Infusion Rate_4 Min	Infusion Rate_6 Min	Infusion Rate_8 Min	Infusion Rate_10 Min	Infusion Rate_12 Min	Infusion Rate_14 Min	Infusion Rate_16 Min	Infusion Rate_18 Min	Infusion Rate_20 Min	Infusion Rate_22 Min	Infusion Rate_24 Min	Infusion Rate_26 Min	Infusion Rate_28 Min	Infusion Rate_30 Min	Infusion Rate_32 Min	Infusion Rate_34 Min	Infusion Rate_36 Min	Infusion Rate_38 Min	Infusion Rate_40 Min	Infusion Rate_42 Min	Infusion Rate_44 Min	Rescue Bolus_2 Min	Rescue Bolus_4 Min	Rescue Bolus_6 Min	Rescue Bolus_8 Min	Rescue Bolus_10 Min	Rescue Bolus_12 Min
28	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
29	96	95	95	95	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72		10	10			
30	98	98	99	99	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
31	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
32	98	97	98	98	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72		4	4			
33	99	98	98	98	60	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72					4	
34	98	96	96	99	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
35	100	100	98	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
36	98	98	98	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
37	98	98	97	97	60	60	60	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72						
38	98	98	98	98	60	60	60	60	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30						
39	100	97	97	97	60	60	30	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED						
40	98	98	98	98	60	60	60	60	60	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30						
41	97	97	98	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
42	98	96	96	99	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
43	98	99	99	98	60	60	30	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	30	30	30	30	30	30	30						
44	99	97	97	97	60	60	60	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72						
45	99	99	97	97	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72		10	10			
46	97	97	97	96	60	60	60	60	30	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED						
47	100	100	99	100	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72				10		
48	97	97	98	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
49	100	98	98	98	60	60	60	60	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30						
50	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
51	100	99	98	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
52	98	98	98	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
53	99	100	99	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
54	100	100	99	100	60	60	60	60	60	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72						

Sr.No.	Sp02_38 Min	Sp02_40 Min	Sp02_42 Min	Sp02_44 Min	Infusion Rate_2 Min	Infusion Rate_4 Min	Infusion Rate_6 Min	Infusion Rate_8 Min	Infusion Rate_10 Min	Infusion Rate_12 Min	Infusion Rate_14 Min	Infusion Rate_16 Min	Infusion Rate_18 Min	Infusion Rate_20 Min	Infusion Rate_22 Min	Infusion Rate_24 Min	Infusion Rate_26 Min	Infusion Rate_28 Min	Infusion Rate_30 Min	Infusion Rate_32 Min	Infusion Rate_34 Min	Infusion Rate_36 Min	Infusion Rate_38 Min	Infusion Rate_40 Min	Infusion Rate_42 Min	Infusion Rate_44 Min	Rescue Bolus_2 Min	Rescue Bolus_4 Min	Rescue Bolus_6 Min	Rescue Bolus_8 Min	Rescue Bolus_10 Min	Rescue Bolus_12 Min
55	100	100	99	99	60	60	60	60	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30						
56	98	98	97	97	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
57	100	99	98	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
58	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
59	96	95	96	96	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60								
60	98	98	100	100	60	60	60	60	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30						
61	96	97	96	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
62	100	100	100	99	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
63	100	100	100	99	60	60	60	60	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30						
64	99	99	100	100	60	60	60	60	60	60	60	60	60	60	60	60	72	72	72	72	72	72	72	72	72	72						
65	98	97	97	98	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72				10		
66	99	100	100	100	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72				10		
67	96	96	96	96	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
68	99	100	99	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
69	98	96	96	99	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
70	99	100	100	99	60	60	60	60	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30						
71	99	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
72	98	98	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
73	98	98	99	99	60	60	60	60	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30						
74	100	99	98	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
75	96	97	96	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
76	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
77	100	100	100	100	60	60	60	60	60	60	30	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED						
78	96	97	96	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
79	97	97	98	97	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72				10		
80	97	99	96	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
81	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						

Sr.No.	Sp02_38 Min	Sp02_40 Min	Sp02_42 Min	Sp02_44 Min	Infusion Rate_2 Min	Infusion Rate_4 Min	Infusion Rate_6 Min	Infusion Rate_8 Min	Infusion Rate_10 Min	Infusion Rate_12 Min	Infusion Rate_14 Min	Infusion Rate_16 Min	Infusion Rate_18 Min	Infusion Rate_20 Min	Infusion Rate_22 Min	Infusion Rate_24 Min	Infusion Rate_26 Min	Infusion Rate_28 Min	Infusion Rate_30 Min	Infusion Rate_32 Min	Infusion Rate_34 Min	Infusion Rate_36 Min	Infusion Rate_38 Min	Infusion Rate_40 Min	Infusion Rate_42 Min	Infusion Rate_44 Min	Rescue Bolus_2 Min	Rescue Bolus_4 Min	Rescue Bolus_6 Min	Rescue Bolus_8 Min	Rescue Bolus_10 Min	Rescue Bolus_12 Min
82	99	99	98	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
83	98	99	99	98	60	60	30	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED						
84	99	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
85	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
86	98	98	99	98	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72				10		
87	100	99	98	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
88	99	100	99	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
89	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
90	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
91	100	100	100	99	60	60	60	60	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30						
92	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
93	100	99	98	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
94	98	96	96	99	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
95	96	96	96	96	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
96	98	99	99	100	60	60	60	60	60	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72						
97	96	97	96	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
98	99	99	99	100	60	60	60	60	72	72	72	72	72	72	72	72	72	72	36	36	36	36	36	36	36	36					4	
99	98	98	98	98	60	60	60	60	60	60	60	60	72	72	72	72	7	72	72	72	72	72	72	72	72	72						
100	100	99	98	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
101	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
102	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
103	97	97	98	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
104	96	96	95	95	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
105	98	98	100	100	60	60	60	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72						
106	100	98	100	100	60	60	60	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72						
107	97	98	98	98	60	60	60	60	60	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72						
108	100	100	100	100	60	60	60	60	60	60	30	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED						

Sr.No.	Sp02_38 Min	Sp02_40 Min	Sp02_42 Min	Sp02_44 Min	Infusion Rate_2 Min	Infusion Rate_4 Min	Infusion Rate_6 Min	Infusion Rate_8 Min	Infusion Rate_10 Min	Infusion Rate_12 Min	Infusion Rate_14 Min	Infusion Rate_16 Min	Infusion Rate_18 Min	Infusion Rate_20 Min	Infusion Rate_22 Min	Infusion Rate_24 Min	Infusion Rate_26 Min	Infusion Rate_28 Min	Infusion Rate_30 Min	Infusion Rate_32 Min	Infusion Rate_34 Min	Infusion Rate_36 Min	Infusion Rate_38 Min	Infusion Rate_40 Min	Infusion Rate_42 Min	Infusion Rate_44 Min	Rescue Bolus_2 Min	Rescue Bolus_4 Min	Rescue Bolus_6 Min	Rescue Bolus_8 Min	Rescue Bolus_10 Min	Rescue Bolus_12 Min
109	100	100	100	99	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
110	98	99	99	98	60	60	30	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	30	30	30	30	30	30	30						
111	99	99	99	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
112	95	95	95	95	96	60	60	60	60	30	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED	STOPPED						
113	100	99	98	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
114	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
115	99	100	100	100	60	60	60	60	60	60	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30						
116	97	98	98	99	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
117	98	100	100	100	60	60	60	60	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72						
118	96	99	98	97	60	60	60	60	60	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72						
119	100	100	100	100	60	60	60	60	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72						
120	98	97	98	98	60	60	60	7	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72				10		
121	96	97	95	96	60	60	60	60	60	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	72						
122	98	97	97	97	60	60	72	72	72	72	72	72	72	72	72	36	36	36	36	36	36	36	36	36	36	36			4			
123	100	100	100	99	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
124	100	99	98	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
125	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
126	100	100	100	99	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
127	100	99	98	98	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
128	97	97	98	98	60	60	60	60	60	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30						
129	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
130	99	99	99	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
131	98	98	98	99	60	60	60	60	60	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30						
132	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
133	100	100	100	99	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						
134	100	100	100	100	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60						

Sr.No.	Rescue Bolus_14 Min	Rescue Bolus_16 Min	Rescue Bolus_18 Min	Rescue Bolus_20 Min	Rescue Bolus_22 Min	Rescue Bolus_24 Min	Rescue Bolus_26 Min	Rescue Bolus_28 Min	Rescue Bolus_30 Min	Rescue Bolus_32 Min	Rescue Bolus_34 Min	Rescue Bolus_36 Min	Rescue Bolus_38 Min	Rescue Bolus_40 Min	Rescue Bolus_42 Min	Rescue Bolus_44 Min	Total amount of drug used	Episodes of hypotension	Intervention for hypotension	Episodes of hypertension	Intervention for hypertension	Episodes of bradycardia	Intervention for bradycardia
1																	12			3	infusion rate reduced by 50% and infusion stopped		
2																	45						
3																	27			1	infusion rate reduced by 50%		
4																	45						
5																	42.8	1	Bolus + infusion increased by 20%	1	infusion rate reduced by 50%		
6																	56.4	1	Bolus + infusion increased by 20%	1	infusion rate reduced by 50%		
7																	45						
8																	45						
9																	56.4	2	Bolus + infusion increased by 20%				
10			10	10													69.6	2	Bolus + infusion increased by 20%				
11	10																60.4	1	Bolus + infusion increased by 20%				
12																	45						
13																	45						
14																	45						
15																	60	2	Bolus + infusion increased by 20%				
16																	45						
17																	61.6	1	Bolus + infusion increased by 20%				
18																	45						
19																	45						
20																	45						
21																	45						
22																	45						
23																	55.4	1	Bolus + infusion increased by 20%				
24																	45						
25																	71.6	2	Bolus + infusion increased by 20%				
26																	45						
27																	45						

Sr.No.	Rescue Bolus_14 Min	Rescue Bolus_16 Min	Rescue Bolus_18 Min	Rescue Bolus_20 Min	Rescue Bolus_22 Min	Rescue Bolus_24 Min	Rescue Bolus_26 Min	Rescue Bolus_28 Min	Rescue Bolus_30 Min	Rescue Bolus_32 Min	Rescue Bolus_34 Min	Rescue Bolus_36 Min	Rescue Bolus_38 Min	Rescue Bolus_40 Min	Rescue Bolus_42 Min	Rescue Bolus_44 Min	Total amount of drug used	Episodes of hypotension	Intervention for hypotension	Episodes of hypertension	Intervention for hypertension	Episodes of bradycardia	Intervention for bradycardia
28																	45						
29																	72.4	2	Bolus + infusion increased by 20%				
30																	45						
31																	45						
32																	60.4	2	Bolus + infusion increased by 20%				
33																	55.4	1	Bolus + infusion increased by 20%				
34																	45						
35																	45						
36																	45						
37	10																60.4	1	Bolus + infusion increased by 20%				
38																	26			1	infusion rate decreased by 50%		
39																	12			3	infusion rate decreased by 50% & infusion stopped		
40																	27			1	infusion rate decreased by 50%		
41																	45						
42																	45						
43																	12	1	infusion restarted at 50%	3	infusion rate decreased by 50% & infusion stopped		
44	10																60.4	1	Bolus + infusion increased by 20%				
45																	72.4	2	Bolus + infusion increased by 20%				
46																	9			3	infusion rate decreased by 50% & infusion stopped		
47																	61.6	1	Bolus + infusion increased by 20%				
48																	45						
49																	26			1	infusion rate decreased by 50%		
50																	45						
51																	45						
52																	45						
53																	45						
54			10	10													69.6	2	Bolus + infusion increased by 20%				

Sr.No.	Rescue Bolus_14 Min	Rescue Bolus_16 Min	Rescue Bolus_18 Min	Rescue Bolus_20 Min	Rescue Bolus_22 Min	Rescue Bolus_24 Min	Rescue Bolus_26 Min	Rescue Bolus_28 Min	Rescue Bolus_30 Min	Rescue Bolus_32 Min	Rescue Bolus_34 Min	Rescue Bolus_36 Min	Rescue Bolus_38 Min	Rescue Bolus_40 Min	Rescue Bolus_42 Min	Rescue Bolus_44 Min	Total amount of drug used	Episodes of hypotension	Intervention for hypotension	Episodes of hypertension	Intervention for hypertension	Episodes of bradycardia	Intervention for bradycardia
55																	26			1	infusion rate decreased by 50%		
56																	45						
57																	45						
58																	45						
59																	45						
60																	26			1	infusion rate decreased by 50%		
61																	45						
62																	45						
63																	26			1	infusion rate decreased by 50%		
64							4										52	1	Bolus + infusion increased by 20%				
65																	61.6	1	Bolus + infusion increased by 20%				
66																	61.6	1	Bolus + infusion increased by 20%				
67																	45						
68																	45						
69																	45						
70																	26			1	infusion rate decreased by 50%		
71																	45						
72																	45						
73																	26			1	infusion rate decreased by 50%		
74																	45						
75																	45						
76																	45						
77																	13			3	infusion rate decreased by 50% & infusion stopped		
78																	45						
79																	61.6	1	Bolus + infusion increased by 20%				
80																	45						
81																	45						

Sr.No.	Rescue Bolus_14 Min	Rescue Bolus_16 Min	Rescue Bolus_18 Min	Rescue Bolus_20 Min	Rescue Bolus_22 Min	Rescue Bolus_24 Min	Rescue Bolus_26 Min	Rescue Bolus_28 Min	Rescue Bolus_30 Min	Rescue Bolus_32 Min	Rescue Bolus_34 Min	Rescue Bolus_36 Min	Rescue Bolus_38 Min	Rescue Bolus_40 Min	Rescue Bolus_42 Min	Rescue Bolus_44 Min	Total amount of drug used	Episodes of hypotension	Intervention for hypotension	Episodes of hypertension	Intervention for hypertension	Episodes of bradycardia	Intervention for bradycardia
82																	45						
83																	12	1	infusion restarted at 50%	3	infusion rate decreased by 50% & infusion stopped		
84																	45						
85																	45						
86																	61.6	1	Bolus + infusion increased by 20%				
87																	45						
88																	45						
89																	45						
90																	45						
91																	26			1	infusion rate decreased by 50%		
92																	45						
93																	45						
94																	45						
95																	45						
96			10	10													69.6	2	Bolus + infusion increased by 20%				
97																	45						
98																	40.8	1	Bolus + infusion increased by 20%	1	infusion rate decreased by 50%		
99			10	10													69.6	2	Bolus + infusion increased by 20%				
100																	45						
101																	45						
102																	45						
103																	45						
104																	45						
105	4																55.4	1	Bolus + infusion increased by 20%				
106	4																55.4	1	Bolus + infusion increased by 20%				
107			10	10													69.6	2	Bolus + infusion increased by 20%				
108																	13			3	infusion rate decreased by 50% & infusion stopped		

Sr.No.	Rescue Bolus_14 Min	Rescue Bolus_16 Min	Rescue Bolus_18 Min	Rescue Bolus_20 Min	Rescue Bolus_22 Min	Rescue Bolus_24 Min	Rescue Bolus_26 Min	Rescue Bolus_28 Min	Rescue Bolus_30 Min	Rescue Bolus_32 Min	Rescue Bolus_34 Min	Rescue Bolus_36 Min	Rescue Bolus_38 Min	Rescue Bolus_40 Min	Rescue Bolus_42 Min	Rescue Bolus_44 Min	Total amount of drug used	Episodes of hypotension	Intervention for hypotension	Episodes of hypertension	Intervention for hypertension	Episodes of bradycardia	Intervention for bradycardia
109																	26			1	infusion rate decreased by 50%		
110																	10	1	infusion restarted at 50 %	3	infusion rate decreased by 50% & infusion stopped		
111																	45						
112																	9			3	infusion rate decreased by 50% & infusion stopped		
113																	45						
114																	45						
115																	28			1	infusion rate decreased by 50%		
116																	45						
117		4															55	1	Bolus + infusion increased by 20%				
118			10	10													69.6	2	Bolus + infusion increased by 20%				
119		4															55	1	Bolus + infusion increased by 20%				
120																	61.6	1	Bolus + infusion increased by 20%				
121			10	10													69.6	2	Bolus + infusion increased by 20%				
122																	42.8	1	Bolus + infusion increased by 20%	1	infusion rate decreased by 50%		
123																	45			1	infusion rate decreased by 50%		
124																	45						
125																	45						
126																	45						
127																	45						
128																	27			1	infusion rate decreased by 50%		
129																	45						
130																	45						
131																	28			1	infusion rate decreased by 50%		
132																	45						
133																	45						
134																	45						

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The Principal
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Subject:: Approval of Plan of Thesis.

This is to inform you that the Faculty of Medical Sciences in its meeting held on 25.09.2023 has approved the plan of thesis of **Shubham Longia,** a student of your college for **MD Anaesthesiology** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis
Infusion of norepinephrine versus phenylephrine for prevention of subarachnoid block induced hypotension in elderly patients undergoing hip and femur surgeries .

Supervisor
Dr. Neeru Luthra
Professor
Dept. of Anaesthesiology,

Co-Supervisor:-
Dr. M. Rupinder Singh
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Co-Supervisor:-
Dr. Pankaj Mahindra
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The student may submit the thesis in triplicate alongwith the plan in triplicate also, to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She may be directed to attach a photocopy of this letter with the forwarding letter while submitting thesis in the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic, if any.

Controller of Examinations

Note :

1. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*

INFUSION OF NOREPINEPHRINE VERSUS PHENYLEPHRINE FOR PREVENTION OF SUBARACHNOID BLOCK INDUCED HYPOTENSION IN ELDERLY PATIENTS UNDERGOING HIP AND FEMUR SURGERY

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED
IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

DOCTOR OF MEDICINE
IN

ANAESTHESIOLOGY

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES
FARIDKOT

JUNE 2022

DR. SHUBHAM LONGIA

DEPARTMENT OF ANAESTHESIOLOGY
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA
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ABSTRACT OF PLAN OF THESIS

Title	Infusion of Norepinephrine versus Phenylephrine for prevention of subarachnoid block induced hypotension in elderly patients undergoing hip and femur surgeries
For the degree of	M.D. Anaesthesiology
Name of the candidate	Dr. Shubham Longia
Supervisor	Dr. Neeru Luthra , Professor, Department of Anaesthesiology, DMCH Ludhiana
Co-supervisor	Dr. M Rupinder Singh , Professor, Department of Anaesthesiology, DMCH Ludhiana Dr Pankaj Mahindra, Professor, Department of Orthopaedics, DMCH Ludhiana
Institution	Dayanand Medical College & Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

INTRODUCTION: Spinal anaesthesia is frequently used for lower extremity surgeries. Sympathetic blockade after spinal anaesthesia results in venodilation which reduces venous return and hence cardiac output and results in hypotension. Therefore, prophylactic use of alpha-adrenergic agonist drugs is recommended which act by inducing constriction of compliant veins, effectively reversing the vasodilatory effects of spinal anaesthesia.

In this study we aim to compare the effect of using prophylactic Norepinephrine versus Phenylephrine infusion for prevention of spinal induced hypotension in elderly population undergoing hip and femur surgeries.

AIM of STUDY: To study the safety and efficacy of Norepinephrine and Phenylephrine infusion in prevention of Subarachnoid block induced hypotension in elderly patients posted for hip and femur surgeries.

MATERIALS AND METHODS: A randomized controlled trial will be conducted on 40 elderly patients (> 60 years of age) undergoing hip and femur surgeries under spinal anaesthesia. An arterial line will be secured using a 20 G arterial cannula in the radial artery. The patients will be divided into two groups: Norepinephrine (NE) and Phenylephrine (PE) -20 each - depending on the drug administered which will be started before giving sub arachnoid block to the patient . All patients will be administered 2.2 ml volume of bupivacaine 0.5% (1.7 ml) with 25 micrograms (0.5 ml) of fentanyl to achieve subarachnoid block Monitoring of invasive arterial blood pressure will be done for first 45 minutes after subarachnoid block and readings will be noted.

CLINICAL SIGNIFICANCE: Hemodynamic changes induced by subarachnoid block are very frequent. These are more pronounced in elderly and they have more tendency for developing perioperative complications because of hypotension.

This study will focus on comparing prophylactic infusion of Norepinephrine versus Phenylephrine for prevention of subarachnoid block induced hypotension in elderly patients.

KEYWORDS: Hip and femur surgeries, Hypotension, Norepinephrine, Phenylephrine, Spinal Anaesthesia, Invasive arterial blood pressure.

(Signature) Candidate	(Signature) Supervisor	(Signature) Co-supervisor	(Signature) Co-supervisor	(Signature) Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"INFUSION OF NOREPINEPHRINE VERSUS PHENYLEPHRINE FOR PREVENTION OF SUBARACHNOID BLOCK INDUCED HYPOTENSION IN ELDERLY PATIENTS UNDERGOING HIP AND FEMUR SURGERY"** exist in the Department of Anaesthesiology at DMC&H, Ludhiana and will be provided to be candidate of will be provided to the candidate. We will see that the data being included in the thesis are genuine and is collected by the candidate himself under our supervision and guidance.

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APPROVAL PROFORMA

BY RESEARCH & ETHICAL COMMITTEE

DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

Name of candidate	Dr. Shubham Longia
Department	Dayanand Medical College And Hospital, Ludhiana
Topic of Thesis	Infusion of Norepinephrine versus Phenylephrine for prevention of subarachnoid block induced hypotension in elderly patients undergoing hip and femur surgery
Likely date of appearing in PG examination	May/June 2024
Date of enrollment	9th March, 2022
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Dr. Harpreet Kaur (Professor & Head, Pathology)	Mr. R K Sharma (Legal Expert)
Dr. Jaspal Singh (Professor & Head, Surgery)	Dr. Ramit Mahajan (Associate Professor, Gastroenterology)
Dr. Dinesh Gupta (Professor & Head, Medicine)	Dr. Anu Sharma (Professor, Anatomy)
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Approved: Yes / ~~No~~

Dr. Sandeep Puri
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Research Committee
Chairperson
Research Committee

Approved: Yes / ~~No~~

Prof. Arvind Malhotra
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Chairperson
Ethics Committee

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

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2	NAME OF THE INSTITUTE	DAYANAND MEDICAL COLLEGE AND HOSPITAL, LUDHIANA
3	COURSE OF STUDY AND SUBJECT	MD ANAESTHESIOLOGY
4	DATE OF ADMISSION OF COURSE	07/ 03/ 2022
5	TITLE OF THE TOPIC	INFUSION OF NOREPINEPHRINE VERSUS PHENYLEPHRINE FOR PREVENTION OF SUBARACHNOID BLOCK INDUCED HYPOTENSION IN ELDERLY PATIENTS UNDERGOING HIP AND FEMUR SURGERIES

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

Spinal anaesthesia is frequently used for lower extremity surgeries .It is induced by injecting small amounts of local anaesthetic into CSF at L3-L4 interspinal levels.

Sympathetic blockade after spinal anaesthesia results in venodilation which reduces venous return causing reduced preload and hence cardiac output and results in hypotension. [1] The occurrence of hypotension after subarachnoid block is very commonly seen in the old age population .In the elderly, the incidence of spinal anaesthesia induced hypotension can be as high as 73%, [2] exposing the vulnerable group to reduced organ perfusion and increasing the risk of perioperative mortality and morbidity.[3,4] The high incidence of hypertension and other comorbid conditions in elderly leads to a high risk for hypoperfusion caused by hypotension.[5] In the old age population , the mechanism of hypotension differs from that in young adults , as it is mainly caused by a reduced stroke volume rather than a decrease in the systemic vascular resistance.[6]

Fluid loading in the form of crystalloids is often suggested as a measure of prophylaxis against spinal induced hypotension. However, the administration of crystalloids can quickly lead to volume overload and signs of Congestive Heart Failure (CHF) in the elderly particularly those with pre existing comorbidities like hypertension , diabetes , coronary artery disease , metabolic syndrome , cardiomyopathy and patients with lower ejection fractions .[7] It has also been found that crystalloid loading is often not effective in maintaining blood pressure.

The lack of effectiveness of intravenous fluid loading following subarachnoid block was due to a sympathetic block which is associated with decreased peripheral vascular resistance, including a decrease in arterial tone.[8]

Therefore, prophylactic use of alpha-adrenergic agonist drugs inducing constriction of compliant veins and thus effectively reversing the vasodilatory effects of spinal anaesthesia is recommended. In addition, its use also reduces the need for unnecessary fluid loading.[1]

Norepinephrine and Phenylephrine are popularly used as vasoconstrictors.

Phenylephrine is a synthetic alpha-agonist vasoconstrictor that has been evaluated during spinal anaesthesia in elderly population and has been the first choice for elective cesarean section deliveries.[9] However, Phenylephrine (being a pure alpha-agonist) was reported to decrease heart rate and cardiac output, which limits its use in patients with reduced cardiac contractility; [10] this fact makes the use of Phenylephrine in elderly patients questionable.[11] Norepinephrine is an alpha-agonist with weak beta-agonist activity , thus , in addition to its vasoconstriction properties, Norepinephrine has modest cardiostimulatory function compared to Phenylephrine.[12] Norepinephrine has been successfully evaluated for prophylaxis against spinal anaesthesia induced hypotension in obstetric anaesthesia .

In a 2015 study done in obstetrics patients comparing the computer controlled variable rate infusion of norepinephrine and phenylephrine to maintain SBP , the authors found that a computer controlled infusion of norepinephrine maintained blood pressure as effectively as phenylephrine but with less bradycardia and less decrease in cardiac output . No significant differences in the neonatal outcome were found.[13]

M Mostafa et al. conducted a randomized controlled trial on 62 elderly (>70 years) patients scheduled for hip fracture surgeries comparing hemodynamic effects of norepinephrine versus phenylephrine infusion for prophylaxis against spinal anaesthesia . Elderly patients scheduled for hip fracture surgery were randomized into two groups - Norepinephrine: group NE receiving Norepinephrine Phenylephrine: group PE receiving Phenylephrine - (31 patients each). The outcomes included mean heart

rate, mean blood pressure, cardiac output, incidence of spinal anaesthesia-induced hypotension, incidence of bradycardia, and incidence of hypertension. The authors compared that though both Norepinephrine and Phenylephrine infusions effectively prevented spinal anaesthesia induced hypotension , Norepinephrine provided more hemodynamic stability than Phenylephrine , maintaining heart rate , higher cardiac output , less reactive bradycardia and hypertension.[1]

However, in the previous studies invasive hemodynamic monitoring has not been used which is the gold standard technique.

In this study we aim to compare the use of infusion of Norepinephrine versus Phenylephrine for prophylaxis of subarachnoid block induced hypotension in elderly (>60 years) undergoing hip and femur surgeries using invasive arterial blood pressure monitoring.

6.2 REVIEW OF LITERATURE

Spinal anaesthesia also called subarachnoid block is a form of neuraxial regional anaesthesia involving injection of a local anaesthetic into the subarachnoid space at L3-L4 vertebral space. It is frequently used for lower extremity surgeries.

The local anaesthetic with or without an opioid injected into the cerebrospinal fluid provides locoregional anaesthesia: true analgesia, motor, sensory and autonomic (sympathetic) blockade.

Hypotension following subarachnoid block is a common complication in the eldelry age group patients posted for surgery.

There are various strategies recommended as prophylactic measures to prevent and treat this spinal anaesthesia induced hypotension.

Non-pharmacological techniques include the use of intravenous fluid administration in the form of crystalloid preload, colloid preload or crystalloid co-load. However majority were found to be non efficacious.

A J Coe et al. reported that in sixty ASA I-II patients, aged 60 years or above scheduled for lower limb surgeries under spinal anaesthesia allocated randomly in 3 groups A, B and C receiving crystalloid preloading with ringer's acetate solution at 16 ml/kg , 8 ml/kg and no volume preload respectively , the incidence of systolic hypotension which required treatment was similar in all three groups.[7]

Langesaeter et al. established that the lack of effectiveness of intravenous fluid loading following subarachnoid block was due to a sympathetic block which is associated with decreased peripheral vascular resistance , including a decrease in arterial tone .[8]

Hence vasopressors came into practice to counteract the decrease in peripheral vascular resistance and increase stroke volume and manage blood, the hypotension occurring as a consequence of subarachnoid block. The choice of vasopressors lies between using a mixed alpha and beta adrenoceptor agonist or a pure alpha adrenoceptor agonist.

Ephedrine, a mixed alpha+beta agonist, has been widely used.[14]

However, work by Critchley et al. on the use of ephedrine during subarachnoid block in elderly patients showed that ephedrine alone, in clinically used dosages, was not always effective in maintaining systolic arterial pressure, failing in 10 out of 27 patients. This was due to a failure of ephedrine to correct the decrease in systemic vascular resistance.[14] The apparent lack of peripheral vasoconstrictive activity of ephedrine was possibly a result of its beta activity . It was also questioned whether elderly patients, because of their reduced physiological reserve, were less capable of responding to ephedrine by increasing their cardiac output.[15]

T. Taivainen et al. studied thirty ASA II-III patients (>65 years) undergoing hip surgery under spinal anaesthesia and compared ephedrine and etilefrine for the treatment of arterial hypotension during spinal anaesthesia and deducted that a marked reduction of blood pressure was successfully treated with ephedrine 0.07 mg/kg or etilefrine 0.03 mg/kg with ephedrine being somewhat more potent than etilefrine.[16]

Zunic et al. studied the influence of the infusion of ephedrine and phenylephrine on the hemodynamic stability after subarachnoid anaesthesia in senior adults. The study groups were compared on the basis of changes in Mean Arterial Pressure (MAP), Cardiac Index (CI) and Heart Rate (HR). The conclusions derived suggested hemodynamic changes after SAB in eldery patients posted for orthopedic surgery can be prevented by an immediate infusion of phenylephrine or ephedrine , use of ephedrine was associated with an increase in CI and HR while phenylephrine maintained a normal range of the two parameters.[5]

Both Phenylephrine and Norepinephrine are considered better alternatives to ephedrine in obstetric cases as well as in elderly patients posted for surgery under spinal anaesthesia.

Ngan Kee et al. in 2015 compared the computer controlled variable rate infusion of norepinephrine and phenylephrine to maintain SBP. After induction, measurements were taken at 1 minute intervals till delivery. Primary outcome compared was cardiac output. The authors found that a

computer controlled infusion of norepinephrine maintained blood pressure as effectively as phenylephrine but with less bradycardia and less decrease in cardiac output.[13]

Chen, Z., Zhou, J., Wan, L. et al., in their study Norepinephrine versus phenylephrine infusion for preventing postspinal hypotension during cesarean section for twin pregnancy: a double-blinded randomized controlled clinical trial, concluded that use of Norepinephrine infusion was not associated with any change in incidence of change in heart rate but a better control of blood pressure was achieved as compared to Phenylephrine.[9]

Hasanin A et al. compared Norepinephrine versus phenylephrine infusion for prophylaxis against post spinal anaesthesia hypotension during elective cesarean delivery and the results showed that infusion Norepinephrine more effectively maintained maternal systolic blood pressure with less incidence of reactive hypertension and bradycardia compared to phenylephrine.[17]

MC Vallejo et al. performed an open label randomised controlled clinical trial comparing continuous Norepinephrine and Phenylephrine infusions in prevention of spinal hypotension during cesarean delivery and results showed that both regimens were effective with similar requirement for rescue boluses and hence they concluded that Norepinephrine can be used as an alternative to Phenylephrine.[18]

M Mostafa et al. conducted a randomized controlled trial on 62 elderly (>70 years) patients scheduled for hip fracture surgeries comparing hemodynamic effects of norepinephrine versus phenylephrine infusion for prophylaxis against spinal anaesthesia. Elderly patients scheduled for hip fracture surgery were randomized into two groups - Norepinephrine: group NE receiving Norepinephrine 8 micrograms/min and Phenylephrine: group PE receiving Phenylephrine 100 micrograms/min - (31 patients each). The outcomes included mean heart rate , mean blood pressure , cardiac output , incidence of spinal anaesthesia-induced hypotension , incidence

of bradycardia , and incidence of hypertension . The authors compared that though both Norepinephrine and Phenylephrine infusions effectively prevented spinal anaesthesia induced hypotension , Norepinephrine provided more hemodynamic stability than Phenylephrine , maintaining heart rate, higher cardiac output , less reactive bradycardia and hypertension.[1]

6.3 AIMS AND OBJECTIVES OF THE STUDY

To study the effect of prophylactic infusion of Phenylephrine and Norepinephrine on prevention of hypotension using invasive blood pressure monitoring.

7. MATERIALS AND METHODS

7.1 SOURCE OF DATA:

A randomized control trial and study will be conducted in the Department of Anaesthesiology, Dayanand Medical College & Hospital, Ludhiana after approval by the Institutional Ethics Committee on a total of 40 elderly patients (age group > 60 years) undergoing hip and femur surgeries under subarachnoid anaesthesia. A written informed consent will be obtained from the patients.

7.2 METHODOLOGY:

Inclusion criteria:

Elderly patients (>60 years) undergoing hip and femur surgeries.

Exclusion criteria:

Patients with a history of allergy to any of the study drugs.

Patients with contra-indications for spinal anaesthesia.

Patient refusal.

GROUP ALLOCATION

A total of 40 elderly (>60 years of age) patients will be included in the study who will be randomly allocated into 2 groups named NE and PE. Randomisation will be carried out using a computer generated random number sequence.

- **GROUP NE** (Norepinephrine group)

A total of 20 patients in group NE will receive prophylactic Norepinephrine infusion.

- **GROUP PE** (Phenylephrine group)

A total of 20 patients in group PE will receive prophylactic Phenylephrine infusion.

TECHNIQUE

Preanaesthetic checkup

All patients will undergo routine thorough pre-anaesthesia checkup one day prior to surgery comprising of detailed history, comorbidities, allergy to any drug being used along with general, systemic and airway examination.

Relevant routine investigations required will be noted. Patients and their attendants will be explained about the study being conducted and written informed consent will be taken.

Anaesthesia technique

The study will be conducted on elderly patients posted for hip and femur surgeries. Pre-operative non invasive blood pressure (NIBP) will be measured. Patients will be kept fasting as per the standard guidelines for fasting before surgery

The premedication given to the patient will be noted. After arrival in the operating room, monitors will be attached to the patient and standard monitoring in the form of five lead ECG, Heart Rate (HR), non-invasive blood pressure (NIBP), oxygen saturation (SpO2) will be done and recorded and baseline hemodynamic measurement will be noted.

Two 20 G intravenous cannula will be secured. An arterial cannula of size 20 G will be inserted into the radial artery of the patient under local anaesthesia. Arterial line monitoring will be started and baseline value will be noted by anaesthesiologist. Fluid administration will be done using balanced salt solution at the rate of 100 ml/hr. A solution of either Norepinephrine 8 micrograms/ml (prepared by diluting 4 mg NE in 500 ml saline) or phenylephrine 100 micrograms/ml (prepared by diluting 10 mg of PE in 100 ml saline) will be started in a 20 G cannula other than the one used for IV fluids at a rate of 60 ml/hour. These concentrations of study solutions will be chosen based on potency ratio 13:1 (Norepinephrine: Phenylephrine) as determined in previous clinical studies. The drugs will be prepared in isotonic saline in 50 ml syringes that will be labeled as “study solution” and will be administered through pressure tubing to the intravenous cannula. Randomisation will be according to the computer generated randomisation codes contained in sealed, sequentially numbered envelopes. Both patients and observer will be blinded to the nature of the study solution being administered.

Patients will be positioned in a sitting position and subarachnoid block will be administered to the patient under all aseptic precautions. After skin infiltration with lignocaine hydrochloride 2% [w/v], a 26-gauge Quincke"s spinal needle will be inserted in the L3 to L4 vertebral interspace. After confirmation of free flow of cerebrospinal fluid, a total of 2.2 ml of volume of bupivacaine 0.5% (1.7 ml) with 25 micrograms (0.5 ml) of fentanyl will be injected intrathecally and patients will be returned back to supine position. Supplemental oxygen at the rate of 5 L/minute using a venturi mask will be given to all patients. If spinal anaesthesia fails, the patient will be excluded from the study and will be managed according to the attending anaesthesiologist"s discretion.

The IABP monitoring will be started before intrathecal injection after the patient is laid down in supine position and reading will be observed and noted at 2 minute intervals until 45 minutes of after subarachnoid block

From the start of intrathecal injection until 45 minutes of subarachnoid block, study solution infusion will be regulated according to the IABP, keeping the target as 100% of baseline SBP. The infusion rate will be regulated as follows:

The infusion of study solutions will be initiated at the rate of 60 ml/hour. Hypotension will be defined as SBP<80% of baseline or an absolute value of less than 100 mmHg and the number of such episodes will be recorded. If SBP is <80% of baseline , it will be set to be managed by 4 micrograms of Norepinephrine or 10 micrograms of Phenylephrine , and the infusion rate will be increased by 20%. If SBP continues to be <80% of the baseline for 2 minutes, we will administer another rescue bolus of NE. Episodes of hypertension (defined as an SBP level of >120%) will also be recorded. If hypertensive episodes persist for 2 minutes, they will be managed by reducing the infusion by 50%. If hypertension persists after reduction of the infusion rate, the vasopressor infusion will be stopped. The vasopressor will be resumed at 50% of the starting dose if there will be a further decline in blood pressure. The total number of rescue boluses

given and total volume of study solution given via the syringe pump up till end of surgery will be recorded. Bradycardia will be defined as HR<50 beats per minute [bpm] will be treated by stopping the study solution if associated with SBP more than or equal to baseline. Bradycardia associated with SBP less than baseline will be treated with intravenous atropine 0.6 mg. The study will be discontinued after 45 minutes of subarachnoid block and the study solution will then be continued on the discretion of the attending anaesthesiologist.

FOLLOWING OUTCOMES WILL BE OBSERVED:

PRIMARY OUTCOME

- Episodes of hypotension (defined as SBP<80% of baseline or an absolute value of less than 100 mmHg).

SECONDARY OUTCOME

- Total amount of Phenylephrine/Norepinephrine used till 45 minutes after subarachnoid block.
- Episodes of Bradycardia.
- Incidence of hypertension.

The following observations will be recorded to analyse the above mentioned outcomes: SBP, DBP, MAP, HR, and SpO 2 - baseline values and then at regular intervals of 1 minute till the end of surgery.

STATISTICAL ANALYSIS:

SAMPLE SIZE CALCULATION:

By using previous study, Chen, Z., Zhou, J., Wan, L. et al. Norepinephrine versus phenylephrine infusion for preventing postspinal hypotension during cesarean section for twin pregnancy: a double-blinded randomized controlled clinical trial. BMC Anesthesiol 22, 17 (2022)., it was observed that the incidence of hypotension was 24% in group A and 6% in group B. Taking these values as reference, the minimum required sample size with 80% power of the study and 5% level of significance is 61 patients in each

study group. To reduce the margin of error, total sample size is taken as 134 (67 subjects in each group).

The formula used in the situation is as under:

$$n = \frac{[Z\ 1-\alpha/2\ \sqrt{2}\ P\ (1-P) + Z\ 1-\beta\ .\sqrt{\{P1(1-P1) + P2\ (1-P2)\}}]2}{(P1-P2)\ 2}$$

Where P= (P1+P2)/2

• Approximate value of efficacy/cure rate for standard treatment =P1

• Approximate value of efficacy/cure rate for other treatment = P2

• Effect size = (P2-P1)

• Level of significance (usually 5%)

• $Z\alpha$ = Value of standard normal variate corresponding to α level of significance (1.96) and $Z\beta$ = The standard normal deviate for desired power (0.842)

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

No

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

8. LIST OF REFERENCES

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PROFORMA

Sr. Number: Group:

MRD Number: Date of surgery:

Age and Sex:

ASA grade:

1. Time From Start Of Study Solution Infusion To 45 Minutes after subarachnoid block In Minutes:

2. Intraoperative Observations:

Norepinephrine/Phenylephrine study solution infusion:

Haemodynamic Parameters inside Operation Theater:

After arterial line insertion and before administration of drug	Heart Rate	ECG Rhythm	IABP(mm Hg)	MAP (mmHg)	SPO2 (%)
1 min					
2min					
3min					
Mean of three readings as baseline					

SIGNATURE OF CANDIDATE SIGNATURE OF SUPERVISOR

After the administration of drug	Heart Rate	IABP(mm Hg)	MAP (mmHg)	SPO2 (%)	Infusion rate of Norepinephrine (ml/hr)	Rescue bolus of NE (if any)	Infusion rate of Phenylephrine (ml/hr)	Rescue bolus of PE (if any)
2 min								
4 min								
6 min								
8 min								
10 min								
12 min								
14 min								
16 min								
18 min								
20 min								
22 min								
24 min								
26 min								
28 min								
30 min								

SIGNATURE OF CANDIDATE SIGNATURE OF SUPERVISOR

32 min								
34 min								
36 min								
38 min								
40 min								
42 min								
44 min								

Total amount of drug used:

Total amount of drug used (mg) = infusion rate x total time of administration of drug upto 45 minutes after subarachnoid block + bolus of drug (if any).

3. Intraoperative Events:

Episodes of intraoperative hemodynamic events	**Number**	**Intervention, if any**
1. Hypotension		
2. Hypertension		
3. Bradycardia		

INFORMED PATIENT CONSENT

Date: _____

I…….D/o, W/o, S/o……..…… am willing to participate in the study **"INFUSION OF NOREPINEPHRINE VERSUS PHENYLEPHRINE FOR PREVENTION OF SUBARACHNOID BLOCK INDUCED HYPOTENSION IN ELDERLY PATIENTS UNDERGOING HIP AND FEMUR SURGERIES"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

……. ……
Signature of the Witness Signature of the patient

Name:

Signature of Candidate **Signature of Supervisor**

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत्नी/पुत्र/पुत्री _____

निवासी _____

इस शोधकार्य "**INFUSION OF NOREPINEPHRINE VERSUS PHENYLEPHRINE FOR PREVENTION OF SUBARACHNOID BLOCK INDUCED HYPOTENSION IN ELDERLY PATIENTS UNDERGOING HIP AND FEMUR SURGERIES**" में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____	_____
गवाह के हस्ताक्षर	रोगी के हस्ताक्षर/अंगूठे का निशान
नाम:	नाम:

_____

अन्वेषक के हस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____

ਵਾਸੀ _____

“INFUSION OF NOREPINEPHRINE VERSUS PHENYLEPHRINE FOR PREVENTION OF SUBARACHNOID BLOCK INDUCED HYPOTENSION IN ELDERLY PATIENTS UNDERGOING HIP AND FEMUR SURGERIES” ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ-ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ – ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

_____ _____

ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____ ਮਿਤੀ_____

ਪਤਾ _____ ਪਤਾ _____

_____

ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

_____

ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ